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MARTIN (L. F.), MCKINNEY (H. H.), & BOYLE (L. W.). **Purification of Tobacco mosaic virus and production of mesomorphic fibres by treatment with trypsin.**—*Science*, N.S., lxxxvi, 2234, pp. 380–381, 1937.

In a typical tobacco mosaic virus purification experiment, the impure virus protein in approximately 1 per cent. solution was incubated for 3 to 5 hours with 3·3 mg. per c.c. of Fairchild's trypsin. The protein precipitable by trichloracetic acid decreased in a few minutes from 11·4 to 8·3 mg. per c.c., and in a few hours the solution assumed an opaque appearance. Apparently pure virus protein had separated at P_H 7·5 in the form of mesomorphic fibres [*R.A.M.*, xvi, pp. 639, 778], which temporarily disintegrated on shaking the solution but re-formed after standing for an hour or two. Acidifying the solution to P_H 5 precipitated fine crystals of the typical needle form of the protein. Assays were made of the virus protein purified by incubation with trypsin and subsequently crystallized, in comparison with crystals obtained in the usual way as controls. All samples were brought to an equivalent protein content, 5·8 mg. per c.c. in 0·1 M phosphate buffer at P_H 7, and used at appropriate dilutions to inoculate the first leaves of eight-day-old Scotia bean (*Phaseolus vulgaris*) plants. The results of the tests indicated that the infectivity of the trypsin-purified protein is equal or superior to that of the controls.

JOHNSON (J.) & HOGGAN (ISMÉ A.). **The inactivation of the ordinary Tobacco mosaic virus by micro-organisms.**—*Phytopathology*, xxvii, 10, pp. 1014–1027, 1 fig., 1937.

The inactivating effect of a number of bacteria and fungi in pure culture on the ordinary tobacco mosaic virus (tobacco virus 1), both in leaf tissue and plant extract, was investigated and found to be much more potent in the latter than in the former group of organisms, especially in destroying the virus in the host tissue. This result is attributed to the low cellulose-decomposing capacity of the bacteria, which prevents them from attaining contact with the virus particles in the cells, which are readily reached, on the other hand, by the fungi with their active cellulose-destroying faculties. Even in extracts permitting direct contact with the virus particles some of the bacteria, e.g., *Bacillus* [*Bacterium*] *radiobacter* [*R.A.M.*, xi, p. 357] and *Phytomonas* [*Bact.*] *tumefaciens*, are comparatively poor inactivators, though others, such as *Aerobacter aerogenes* [ibid., v, p. 439; xiv, p. 403], rapidly

inactivate the virus in these circumstances. Of the 25 fungi used in the tests, *Sclerotinia fructigena* and *Venturia inaequalis* were particularly efficient inactivators but all were capable of destroying the active principle of the virus given a sufficient length of time—sometimes exceeding four months at room temperature.

In some cases it was possible greatly to expedite the rate of both bacterial and fungal inactivation of the virus by aeration of the cultures by the continuous mechanical rocking of two-arm culture tubes. The same process, applied to sterile virus extract for periods up to 28 days, not only failed to cause inactivation but resulted in a fairly marked increase in the number of local lesions on hybrid tobacco (*Nicotiana tabacum* × *N. glutinosa*) leaves as compared with non-aerated extracts. The complete exclusion of oxygen from virus-infected moist soil largely or entirely inhibits the inactivation of the virus therein owing to the reduced activity of the aerobic soil organisms.

Bacteria and fungi in pure culture occasionally attenuate only a small percentage of tobacco virus 1, but over 98 per cent. of the local lesions tested from cultures in which the virus was almost completely inactivated yielded normal virus on re-inoculation into tobacco.

BALD (J. G.). **The use of numbers of infections for comparing the concentration of plant virus suspensions. 4. Modification of the simple dilution equation.**—*Aust. J. exp. Biol. med. Sci.*, xv, 3, pp. 211–220, 1937.

Infection dilution data published by Stanley [*R.A.M.*, xvi, pp. 499, 567], using crystalline protein of ordinary tobacco mosaic and aucuba mosaic, agree well in part with the equation $y/N = 1 - e^{-p n_1 x}$ recently propounded by the author [ibid., xvi, pp. 495, 498], but some of the figures are widely divergent and if the protein is pure virus some doubt is thrown on the suggestion previously made that distortion of the dilution series is mainly due to the presence of impurities. The most likely explanation of the fall in infective power with increasing concentrations of virus now appears to be that it is due to an aggregation of virus particles.

An equation showing the relation between the concentration of free virus particles and aggregates and the concentration of single virus particles is therefore developed by the author, on the assumption that virus particles in solution aggregate by joining end to end in chains, and on this basis the probability of infection is given by $y/N = 1 - e^{-q n_x}$ where q is the probability of one or more particles per unit volume of inoculum entering the tissues. The equation is fitted to dilution experiments with purified samples of the streak, ordinary tobacco, and aucuba mosaic viruses and agreement within the limits of experimental error obtained in most cases with virus samples buffered near the neutral point and even with unbuffered samples.

MANIL (P.) & GRATIA (A.). **Transmission du virus de la mosaïque ordinaire du Tabac à l'Orobanche, plante parasite dépourvue de chlorophylle.** [The transmission of the ordinary Tobacco mosaic virus to *Orobanche*, a parasitic plant devoid of chlorophyll.]—*C.R. Soc. Biol., Paris*, cxxvi, 24, pp. 67–69, 1937.

The juice of an *Orobanche* (probably *O. minor*) stem inoculated in

infinitesimal quantity into *Nicotiana glutinosa* induced the typical local lesions of tobacco mosaic. The *Orobanche*, which was parasitizing a mosaic tobacco plant in a greenhouse at the Gembloux (Belgium) Agricultural Institute, showed no outward signs of disease. The virus concentration in the juice extracted from the stem of *O. minor* and that of its host was experimentally shown by local lesions on *N. glutinosa* and by serological tests to be of the same order of magnitude. This is believed to be the first record of a virus disease among the Orobanchaceae.

Reid (J. J.), Haley (D. E.), McKinstry (D. W.), & Surmatis (J. D.). **The relation of catalase activity to the microflora of cured and fermenting Tobacco.**—Abs. in *J. Bact.*, xxxiv, 4, p. 460, 1937.

An extensive microflora was detected on the leaves of cured Pennsylvania cigar-leaf tobacco, largely consisting of bacteria and species of *Aspergillus*, *Penicillium*, and *Rhizopus*. Poor-grade tobacco showed fewer bacteria than that of superior quality, but was apt to bear a larger number of fungi. Catalase activity of the cured product was found to be directly related to high bacterial counts.

Allan (J. B.), Hill (A. V.), & Angell (H. R.). **Downy mildew (blue mould) of Tobacco: its control by benzol and other vapours in covered seed-beds. III.**—*J. Coun. sci. industr. Res. Aust.*, x, 4, pp. 295–308, 2 figs., 1937.

Comparative experiments were made during 1936 and 1937 at Eurobin (Victoria), Swan Hill (Victoria), and Canberra, to ascertain the efficacy in the control of downy mildew of tobacco (*Peronospora tabacina*) [*R.A.M.*, xvii, p. 77] of the vapours of benzol, toluol, X3 solvent, X300 special boiling-point spirit, C.O.R. benzol mixture, 'Plume' cracked motor spirit, H 74, iodine, and quinone applied to the seed-beds under different climatic conditions. It was found that only benzol gave complete protection from the disease and that only toluol and X3 were likely to be useful as substitutes.

The optimum concentration of benzol vapour varied with the temperature and proximity to sources of infection. The concentration provided by evaporation from a surface 1/72 of the seed-bed area always prevented the disease, but an evaporation surface of 1/100 may be used successfully provided that the sources of infection are distant.

Studies on the relative efficacy of hydrocarbons, including petroleum fractions, showed that the degree of control effected by them depends on their content of aromatics of low boiling-point. It was found that toluol and X3 solvent act identically in distillation and evaporation. Distillation ranges and comparative rates of evaporation demonstrated clearly that aromatics higher in the series than toluene should not be used. Under the conditions of the experiments the most effective control was obtained by using benzol vapour in seed-beds uncovered for 11 hours on fine days and in others uncovered for 9 hours each day irrespective of weather conditions. The authors avoided, in the course of their experiments, the damping-off and other troubles of seedlings grown in covered beds by weekly treatment with Cheshunt mixture. For

the dressing of the calico seed-bed covers they recommend shirlan AG, which prevents fungal discoloration and other signs of deterioration.

McLean (Ruth), Wolf (F. A.), Darkis (F. R.), & Gross (P. M.). **Control of downy mildew of Tobacco by vapours of benzol and of other organic substances.**—*Phytopathology*, xxvii, 10, pp. 982–991, 3 figs., 1937.

The results of experiments in North Carolina confirmed those obtained in Australia in regard to the efficacy of benzol vapour in the control of tobacco downy mildew (*Peronospora tabacina*) [see preceding abstract], and further demonstrated a similar fungicidal action in the case of monochlorbenzene. The admixture with benzol vapour at high concentrations of lubricating oil in the ratio of 1:5 by volume retards the evaporation of benzol and so prevents the toxic effect liable to be exerted by the latter on tobacco seedlings without impairing the efficacy of the treatment. It is important to employ properly constructed beds for the vapour treatments, during which the beds should be covered with a cotton fabric of the texture of sheeting. The evaporators should have a surface approximating to 1/72 of that of the seed-bed and be provided with sufficient clearance to allow of free evaporation.

Hopkins (J. C.). **Seasonal notes on Tobacco diseases. 10. Precautionary methods in seed-beds.**—*Rhod. agric. J.*, xxxiv, 10, pp. 770–772, 1937.

Precautionary measures recommended in the preparation of tobacco seed-beds in Rhodesia for the prevention of seedling diseases such as frog eye [*Cercospora nicotianae*: *R.A.M.*, xvi, p. 780] are: changing the site of the seed-bed, destruction of refuse from previous seasons, use of healthy seed, thin sowing, sterilization of the seed-bed covers with formalin or hot water, and frequent regular spraying of the seedlings with Bordeaux mixture (4–4–50).

Park (M.). **A note on the occurrence of blossom-end rot of Tomatoes at Anuradhapura, 1937.**—*Trop. Agriculturist*, lxxxix, 3, pp. 141–147, 1 graph, 1937.

Experimental applications of artificial fertilizers in 1936–7 at Anuradhapura failed to affect the incidence of blossom-end rot of tomatoes [*R.A.M.*, xvi, p. 502], a disease which is stated to be common in Ceylon, frequently causing considerable losses. A direct relationship was observed, however, between fluctuations in the amount of precipitation within a given interval and the development of the disease; thus, while the average percentage of diseased fruits in the total number gathered was about 20, the picking on 9th January, 1937, following seven days' exceptionally heavy rainfall, contained as much as 41·8 per cent. fruits affected with blossom-end rot. The collection of further data on the problem is considered desirable.

Bertus (L. S.). **Blossom-end rot of Tomato fruits.**—*Trop. Agriculturist*, lxxxix, 4, pp. 220–221, 1 pl., 1937.

This is a brief, semi-popular account of blossom-end rot of tomato fruit [see preceding abstract] in Ceylon. Control recommendations

include regular watering, efficient drainage, aeration, and mulching of the soil, light shading, and the avoidance of fresh cattle manure and large quantities of fertilizers.

ORTH (H.). **Die Bakterienwelke der Tomaten.** [Bacterial wilt of Tomatoes.]—*Kranke Pflanze*, xiv, 10, pp. 161–163, 1937.

This is an abridged version of the writer's studies on bacterial wilt of tomatoes *Bacterium* [*Aplanobacter*] *michiganense* in Germany, a fuller account of which from another source has already been noticed [*R.A.M.*, xvii, p. 80]. It is stated in a footnote to this paper that kortofin (Chem. Fabrik Marktredwitz, Bayr. Ostmark) may be used as a substitute for 0·1 per cent. mercuric chloride for the disinfection of knives or fingers during the removal of young shoots.

HENDRICKX (F. L.). **Sur l'antagonisme existant entre une bactérie et l'agent [Ophiostoma ulmi (Schwarz) Nannfeldt] de la maladie de l'Orme (Ulmus sp.).** [On the antagonism existing between a bacterium and the agent [*Ophiostoma ulmi* (Schwarz) Nannfeldt] of the Elm (*Ulmus* sp.) disease.]—*C.R. Soc. Biol., Paris*, cxxvi, 24, pp. 99–100, 1937.

Among the organisms isolated from an elm branch affected by parasitic tylosis in Belgium, besides the agent of the disease (*Ophiostoma* or *Ceratostomella ulmi*) [*R.A.M.*, xvii, p. 142], was a bacterium which exercised an inhibitory action on the development of the fungus both *in situ* and in malt agar cultures (P_H 6·5). A culture of the organism [which is briefly described] on a strongly buffered synthetic medium, sterilized for half an hour at 112° C., exerted no marked inhibitory action on the elm pathogen but stimulated its sporulation.

CAMPBELL (W. A.). **The cultural characteristics of Fomes connatus.**—*Mycologia*, xxix, 5, pp. 567–571, 2 figs., 1937.

The cultural characteristics of *Fomes connatus* [*R.A.M.*, xv, p. 66] are given based on two isolations of the fungus, one obtained from decayed hard maple bearing fruit bodies and the other from spores from a sporophore on *Acer negundo*. Both *A. saccharum* and *A. rubrum* are stated to be common hosts of the fungus among the northern hardwoods of the United States.

The fungus grows slowly forming a mat, usually cottony, over the inoculum, becoming appressed towards the margin, azonate, occasionally with sectors. The submerged hyphae, 2 to 5μ in diameter, are often much contorted and twisted, without clamp-connexions; the superficial hyphae are similar, thin-walled, non-staining when empty, and fibrous hyphae 2 to 4μ with moderately thick walls occur commonly in old cultures. On gallic acid medium there was a faint to moderately strong brown diffusion zone with no growth in seven days, and on tannic acid medium a faint diffusion zone and no growth. The optimum temperature for growth was about 25° C. and none occurred at 35° C. The best growth of the fungus on agar was secured on potato dextrose and 5 per cent. malt media. On sterilized hard maple blocks the fungus grew vigorously, completely covering them with a dense thick cottony growth. The isolation from *A. negundo* produced in a tube culture a

well-defined poroid area with cystidia and spores characteristic of *F. connatus*.

Pārskats par kaitēklu un slimību izplatību Latvijas valstsmežos 1935/36 g. [A summary of the incidence of tree pests and diseases in the silvicultural properties of Latvia in 1935–36.]—Reprinted from *Latvijas mežu statist.* [*Statist. for.*], ix, 11 pp., 1937. [French summary.]

Lophodermium pinastri [*R.A.M.*, xvi, p. 847] is stated to be the most injurious fungal pathogen of pines in Latvia [ibid., xv, p. 610], where spraying with lime-sulphur is practised for its control, especially in nurseries. The same host was further attacked during the period under review by *Fomes annosus* [ibid., xvii, p. 5] (also occurring on spruce), *Peridermium pini* [ibid., xvii, p. 87], *Melampsora pinitorqua* [ibid., xv, p. 618], and *Trametes* [*F.*] *pini* [ibid., xvi, p. 848], while *F. igniarius* [ibid., xvi, p. 715] is prevalent on aspens.

Grimm (W.). **Beitrag zur Lösung des Lärchenrätsels.** [A contribution to the solution of the Larch problem.]—*Forstwiss. Zbl.*, lix, 16, pp. 501–512; 17, pp. 540–549, 1937.

Disturbances in transpiration associated with adverse environmental factors are suspected by the writer to be the primary cause of the baffling dying-off of larches of recent years in Germany [*R.A.M.*, xvi, p. 508]. The trees thus weakened are readily accessible to infection by the canker-producing fungus [*Dasyscypha willkommii*]. After the age of 30 to 40 years the larch roots reach a soil depth at which the balance of humidity and moisture relations becomes more stabilized, and from this stage onwards recovery frequently ensues. Discussing his investigations in relation to silvicultural practice, the writer emphasizes the superiority of the Sudetic over the Alpine larch from the standpoint of disease resistance, and the advisability of using the former for extended cultivation in regions to which the tree is not indigenous.

Kisser (J.) & Lohwag (K.). **Histochemische Untersuchungen an verholzten Zellwänden.** [Histochemical studies on lignified cell walls.] —*Mikrochemie*, xxiii, 1, pp. 51–60, 2 figs., 1937.

The intensive histochemical examination at the Biological Institute of the Vienna Academy of Sciences of silver fir (*Abies alba*) wood showed that the tangential walls of recently formed cells swell much more readily than the radial walls or those of older material. This explains the characteristic disintegration produced in the wood by *Fomes hartigii* [*R.A.M.*, xvii, p. 86], which spreads principally in the old cells and dissolves the tangential walls.

Jaag (O.). **Sur une nouvelle maladie du Sapin blanc et de l'Épicea.** [On a new disease of the Silver Fir and of the Spruce.]—*J. for. suisse*, lxxxviii, 9–10, pp. 201–203, 2 pl., 1937.

This is a summary, translated from the German by J. P. C., of O. Jaag's account of the new silver fir and spruce disease in Switzerland caused by *Pleurotus mitis*, a review of which from another source has already appeared [*R.A.M.*, xvi, p. 717].

The properties of British Honduras Pitch Pine (Slash Pine).—Pinus caribaea Mor.—*For. Prod. Res. Rec., Lond.*, 20, 9 pp., 2 pl., 1 map, 1937.

The results of experiments at the Forest Products Research Laboratory at Princes Risborough showed that the heartwood of the British Honduras pitch pine (*Pinus caribaea*) is moderately resistant to the attacks of *Merulius lacrymans*, *Coniophora cerebella* [*C. puteana*], *Poria vaporaria*, *Lenzites saepiaria*, and *L. trabae*; it was, however, slightly more susceptible to rotting by *Lentinus lepideus*, which was observed in the heartwood of one of the logs received at the laboratory from British Honduras. It is considered, therefore, that although *P. caribaea* timber should usually prove fairly durable under conditions favourable to decay, it would be unwise to use it untreated for telegraph poles, railway sleepers, or constructional work in exposed situations.

Kemper (W.). **Zur Morphologie und Zytologie der Gattung Coniophora, insbesondere des sogenannten Kellerschwamms.** [On the morphology and cytology of the genus *Coniophora*, especially of the so-called cellar fungus.]—*Zbl. Bakt.*, Abt. 2, xcvii, 4–8, pp. 100–124, 20 figs., 1937.

The writer fully describes his cytological examination of the so-called cellar fungus (*Coniophora cerebella* [*C. puteana*]) and *C. arida*, a closely related species differing from the former chiefly in its brownish-yellow to dark brown fruit bodies with a white to yellow border growing out into a delicate white mycelium under humid conditions. The fructifications of *C. puteana* are at first livid olive, turning brown to sooty-black. The strain of *C. puteana* chiefly used in the studies was supplied by the Botanical Institute of the Hann.-Münden College of Forestry and rapidly formed fruit bodies on beech and spruce wood. Three strains of *C. arida* were obtained from fructifications collected in the vicinity on dead spruce branches.

The spores on germination give rise to a coenocytic mycelium, the rapidly growing hyphal tips of which soon protrude above the malt agar substratum. Clamp-connexions are formed only on such aerial hyphae. The development of the whorl clamp-connexions characteristic of the genus is preceded by that of single and double anastomoses. An increase of atmospheric humidity tends to suppress the formation of clamp-connexions. Conidia are not formed. Both species are monoecious and in a sense polyploid, and cytological details regarding each are given. The results of experiments to determine the capacity of *C. puteana* and *C. arida* for the destruction of sterilized wood blocks showed that oak is much more resistant than beech to the attacks of these fungi. *C. arida* causes more extensive disintegration of spruce and pine wood than *C. puteana*.

Mörath (E.). **Holzschutz in Deutschland.** [Wood protection in Germany.]—*Umschau*, xli, 37, pp. 849–851, 3 figs., 1937.

Following a brief exposition of the economic aspects of timber preservation in Germany, the writer concisely presents some useful information [much of which has already been noticed in this *Review* from other sources] concerning modern methods of impregnation against

wood-destroying fungi. The possibilities of preservation are largely determined by the anatomical structure of the different woods. Beech, for instance, is completely permeable throughout, whereas in oak the irregular conformation of the annual rings and the partial closure of the heartwood vessels prevent the thorough and uniform penetration of the preservative. For this reason the average life of well-impregnated beech wood, which in the untreated state lasts only 2 to 3 years, is 30 to 50 years, whereas the corresponding figure for the inherently fairly durable oak (average life untreated 13 years) is only 25 years. Recent experiments on leaching-out have shown that the U salts [*R.A.M.*, xvi, p. 503] compare very favourably in this respect (40 per cent. lixiviation under the most rigorous conditions) with pure fluorides, copper sulphate, zinc chloride, and silicofluorides (90 per cent.), though the corresponding figure for mercuric chloride is only 5 per cent.

CRÜGER. **Hausschwamm-Untersuchungen für die Praxis.** [Advisory investigations on dry rot.]—*Angew. Bot.*, xix, 5, pp. 541–542, 1937.

Among the points of interest emerging from the inspection, during the period from 1928 to 1936, inclusive, at the Königsberg Plant Protection Station, of 742 wood samples suspected of dry rot infection may be mentioned the larger number of fructifications of *Merulius lacrymans* (the preponderating fungus concerned in the damage) during the summer months than at other seasons. In addition to *M. lacrymans*, which was present on 311 of the samples examined, *M. minor* and *M. sclerotiorum* [*R.A.M.*, xiii, p. 341] occurred in isolated instances, while *Coniophora*, *Polyporus*, and *Lenzites* spp. were also prevalent. Wood-destroying fungi are responsible for heavy annual losses in constructional and other commercial timbers in Germany, which could be greatly minimized by the diffusion among builders, contractors, and farmers of appropriate wood preservation propaganda.

TROTTER (H.). **Open tank treatment with ascu.**—*Indian For.*, lxiii, 10, pp. 672–675, 3 pl., 1937.

Details are given of a number of experiments to determine the most effective and economical method of applying the ascu method of timber preservation [*R.A.M.*, xvi, p. 359] to chir [*Pinus longifolia*] and sal [*Shorea robusta*] billets. The best results were obtained by slow heating in water (40 minutes rising to 98° C. and 10 minutes boiling at 98°) followed by one hour's immersion in a tank of cold ascu, which gave practically complete penetration with an average absorption of the preservative of 12 to 13 lb. per cu. ft.

Memento [du Service de la] Défense des Végétaux [Maroc] [Memoranda of the Plant Protection Service of Morocco].—37–48, 50, 62 pp., 45 pl., 1937.

No. 37 of this series of semi-popular pamphlets, dealing with the occurrence and control of plant diseases in Morocco, gives an account of blossom-end rot of tomatoes [see above, p. 212], which has been found to be more prevalent on the thin-skinned varieties than on the ribbed type of fruit commonly grown locally, while *Lycopersicum cerasiforme*, *L. piriforme*, and *L. pimpinellifolium* appear to be immune. Tomato

septoriosis (*Septoria lycopersici*) [*R.A.M.*, xvi, p. 655; xvii, p. 15, *et passim*] is stated in pamphlet 38 to cause considerable damage in the maritime regions of the country, especially where the routine treatment of the plants with Bordeaux mixture is omitted.

A more extensive account of artichoke [*Cynara scolymus*] anthracnose (*Ascochyta hortorum*) than that presented in pamphlet 39 of this series has already been noticed from another source [ibid., xv, p. 770]. The same host is stated in pamphlet 40 to be very liable to severe infection by *Ramularia cynarae* [ibid., vii, p. 556], the agent of greyish lesions on the foliage and inflorescences; in addition to appropriate cultural measures, the treatment of the growing crop (up to the time of head formation only) with copper-containing mixtures is recommended.

Tomatoes, potatoes, eggplants, and other Solanaceae are attacked by *Alternaria solani* [ibid., xvii, p. 60], good control of which may be secured, according to pamphlet 41, by applications of Bordeaux mixture, while disinfection of the seed-bed with formalin (2 in 100) a week before sowing considerably reduced the infection of young plants at the collar. The same hosts, besides a number of others, are stated in pamphlet 42 to suffer from rhizoctoniosis (*Rhizoctonia* [*Corticium*] *solani*). The use of mercuric compounds for the control of the disease [ibid., xvi, p. 770] being prohibited by French Moroccan law, the tubers should be disinfected by two to three minutes' immersion in 40 per cent. formaldehyde (1½ l. in 1 hectol. of water heated to 48° or 50° C.) or two hours in copper sulphate (1 kg. per hectol. water).

Pamphlet 43 is concerned with *Sclerotinia libertiana* [*S. sclerotiorum*] which attacks a number of kitchen-garden plants, such as beans [*Phaseolus vulgaris*], peas, carrots, potatoes, beets, Jerusalem artichokes [*Helianthus tuberosus*: ibid., xv, p. 421], cabbage, lettuce [ibid., xvii, p. 6], vegetable marrow, certain industrial crops like hemp [ibid., xv, p. 97], and is occasionally found on vines [ibid., xiii, p. 746], plums, almonds, figs, and citrons [cf. ibid., xvii, p. 15]. Preventive measures [which are indicated] are more effective than curative treatments against this pathogen.

In pamphlet 44 an account is given of the mildew of Compositae, chiefly romaine lettuce and artichoke [*Cynara scolymus*], caused by *Bremia lactucae* [ibid., xv, p. 420]. Copper-containing mixtures may safely be applied to artichokes before heading, but are inadvisable in the case of lettuce on account of their liability to stain the sensitive foliage. *Leveillula* [*Oidiopsis*] *taurica* [ibid., xvii, p. 15], the agent of white mould of artichokes [*C. scolymus*] (pamphlet 45) and other market-garden crops, such as tomatoes and eggplants, is amenable to control by regular applications of an alkaline Bordeaux mixture.

Pamphlet 46 deals with pea bacteriosis (*Pseudomonas pisi*) and its control by thirty minutes' to one hour's immersion of the seed in 0·5 per cent. formalin.

In pamphlet 47 vine downy mildew (*Plasmopara viticola*) is discussed at some length. Among the most resistant varieties under local conditions are York-Madeira, Couderc 132–11, 7120, and 3, Noah, Clinton, Black Defiance, Seibel 4121, 4762, 5455, 5813, 5912, 6468, 4986, 5213, 880, 1000, 1070, 1077, 2859, B.S. 872, S. 5860, 5061, and 5409, Aramon-Rupestris-Ganzin No. 1, and C. 106–46.

Pea melanosis (*Mycosphaerella pinodes*) [ibid., xvi, p. 435] is described in pamphlet 48. It is best controlled by the exclusive use of seed from healthy pods, four- to five-year crop rotation, and other cultural measures. Similar practices are recommended in pamphlet 50 against *Phytomonas* [*Bacterium*] *medicaginis* var. *phaseolicola* on beans (*Phaseolus*) [*vulgaris*: ibid., xvii, p. 13 *et passim*], except that in the case of this parasite a triennial crop rotation suffices to eliminate infection from the soil. The varieties reputed to be resistant to the disease in Europe have all been attacked in Morocco.

BLANK (L. M.). **Fusarium resistance in Wisconsin All Seasons Cabbage.** —*J. agric. Res.*, lv, 7, pp. 497–510, 3 figs., 4 graphs, 1937.

This is a full report of the author's studies, both in the field and in the greenhouse under partial and full control of soil temperatures, on the nature and inheritance of resistance to *Fusarium conglutinans* [*R.A.M.*, xvi, p. 159] in the Wisconsin All Seasons cabbage variety, a brief reference to which has been noticed from another source [ibid., xv, p. 3]. This variety was found to carry at least two types of resistance, the first of which (type A), due to a single dominant gene, is apparently similar to that described for other varieties of cabbage, Brussels sprouts, and kohlrabi, and remains effective at relatively high soil temperatures (about 20° C.); it was demonstrated in the progenies of many of the plant selections, and was transmitted through the three generations of the material studied. The second (B) type is apparently similar to that described for Wisconsin Hollander [ibid., xiv, p. 732], and is genetically complex; it is most effectively expressed at the lower soil temperatures. In the field tests, the efficacy of type B resistance varied in the several progenies, certain of which showed no external symptoms of the disease, while others developed a considerable percentage of mild infection, and still others promptly succumbed to the disease. In the greenhouse experiments with controlled soil temperatures, the expression of type B resistance was suppressed, all progenies being eventually killed. Under conditions of semi-controlled or fluctuating temperatures, it was partially expressed, resulting in a delayed and less severe development of yellows symptoms. The greenhouse tests also indicated the existence of various types of type B resistance.

In the Wisconsin All Seasons variety the severity of yellows is considered to be dependent on the genetic make-up of the plants with reference to type A and type B resistance, on soil temperatures, and possibly also on other conditions influencing the expression of resistance.

PARBERY (N. H.). **Magnesium deficiency in Cabbages and Cauliflowers.**— *Agric. Gaz. N.S.W.*, xlviii, 10, pp. 556–558, 577, 5 figs., 1937.

A diseased condition, suggestive of magnesium deficiency, of cabbages and cauliflowers, is stated to be prevalent, especially in seed-beds, in commercial horticultural holdings at Revesby, Bankstown district, in New South Wales, on very acid soils deficient in the element. In the early growth stages of the plants the trouble appears as yellowish to yellowish-green blotches between the veins, gradually grading into the normal green tissue bordering the mid-rib and the main lateral veins; the seedling leaves are thick and brittle and tend to curl inwards. In

older plants, larger yellow blotches occur between the veins, and in the most severely affected leaves the blotches coalesce to form yellow bands demarcated by the main lateral veins. Cabbages may be distorted, the leaves becoming thickened and tending to curl into ladle-like shapes. Comparative analysis of healthy and diseased plants showed that the magnesium content was 0·95 and 0·72 per cent., respectively. It is believed that the condition may be controlled by applications to the soil of magnesium-bearing limestone or dolomite.

Cook (H. T.). **Spinach and Cabbage seed treatment.**—*Bull. Va Truck Exp. Sta.* 96, pp. 1491–1510, 5 figs., 1937.

Experiments have been in progress during the last five years to determine the relative value of a number of fungicidal dusts in the control of [unspecified] fungi on cabbage and spinach seed [*R.A.M.*, xiv, p. 673]. The 1935 tests showed that, even under conditions specially conducive to seed decay, satisfactory spinach stands could be obtained with 20 or 30 per cent. less seed than is generally used, provided suitable treatment is given. As regards the rate of application, 1·5 per cent. was found to be about the correct dosage for the various copper and zinc preparations used, affording adequate protection without leaving much excess dust in the treating machine or seed drill.

Zinc oxide (Mallinckrodt's), red copper oxide (in the form of cuprocide [ibid., xv, p. 552] manufactured by the Rohm and Haas Co.), and vasco 4 containing zinc oxide and hydroxide and costing only about half as much as red copper oxide, proved uniformly effective for the purpose in view. AAZ special zinc oxide (which costs about a third of red copper oxide) and copper oxychloride (both supplied by Rohm and Haas, the latter under the name of copper compound KB) gave good control in some of the plots but were not as consistently reliable as the foregoing, while fungex (Metals Refining Co.) was less effectual. An old, dark brown, red copper oxide proved to be as toxic to the seed-rotting fungi as a fresh, bright sample, indicating that considerable oxidation of the compound may take place without impairing its antiseptic properties. Semesan proved inferior to any of the other materials used in the tests on spinach seed, but ceresan gave very promising results and merits further trial. Microfyne graphite [ibid., xvi, p. 720] (Joseph Dixon Crucible Co.) exerted no fungicidal action itself but reduced the amount of friction caused by the various seed treatments and the wear and breakage of the drills, and its continued use is therefore recommended.

The incidence of spinach seed decay is most extensive in soils with a moderate to high moisture content and a similar temperature range at and immediately following planting—conditions that usually prevail at the time of early autumn sowing.

Seed decay in cabbage was prevented by zinc oxide, red copper oxide, vasco 4, and semesan, but red copper oxide is liable to cause stunting besides being less toxic than zinc oxide or vasco 4 to the organisms concerned, while the two latter, unless mixed with graphite, caused severe damage to the seed by friction.

It is apparent from these tests that the treatments under investigation are specific for certain kinds of seeds. Spinach may be safely

treated with red copper or zinc oxide, whereas the former may injure cabbage; peas, on the other hand, are stimulated by red copper but stunted and yellowed by zinc oxide.

Osvald (H.) & Petersson (G.). **Experiments with boron against heart rot.**—*Ann. agric. Coll. Sweden*, iv, pp. 233–258, 4 figs., 1 map, 1937.

This is a detailed account of experiments in the control of heart rot of sugar beets in Sweden by means of boron, a summary of which has already been noticed from another source [*R.A.M.*, xv, p. 416].

Schmidt (E. W.) **Der Wurzelbranderreger Phoma betae als Blattfleckenpilz der Rübe.** [The root rot agent *Phoma betae* as leaf-spot fungus of the Beet.]—*Dtsch. Zuckerindustr.*, lxii, 44, pp. 988–989, 5 figs., 1937.

Positive results were obtained at Kleinwanzleben in inoculation experiments on beet leaves with pure cultures of *Phyllosticta tabifica* from the foliage [*R.A.M.*, xiv, p. 396] and of *Phoma betae* from the stems [ibid., xvii, p. 90], thereby confirming the conclusion of Wollenweber and Hochapfel in their studies on *Phoma* [ibid., xvi, p. 105] that *Phyllosticta tabifica* is merely the late summer and autumn foliar phase of the *Phoma betae* spring root rot.

Schmidt (E. W.). **Zwei in diesem Jahre stark aufgetretene Blatterkrankungen der Zuckerrübe.** [Two leaf diseases of the Sugar Beet of widespread occurrence in the current year.]—*Dtsch. Zuckerindustr.*, lxii, 43, pp. 962–963, 2 figs., 1937.

Two relatively uncommon sugar beet leaf diseases were favoured by the alternations of hot weather with heavy rainfall or high atmospheric humidity prevailing in Germany during the summer of 1937, viz., *Cercospora* [*beticola*: *R.A.M.*, xv, p. 763] and *Alternaria tenuis* [ibid., xiv, p. 281], the former paving the way for infection by the latter. Considerable economic damage was caused by this exceptional coincidence of the two fungi under observation.

Zaumeyer (W. J.) & Wade (B. L.). **Varietal reaction of Pea to Pea-streak virus 1.**—*Phytopathology*, xxvii, 10, pp. 1009–1013, 1937.

All the 47 pea varieties tested in the greenhouse in 1934 and 1936 for their reaction to streak virus 1 (a description of which is pending in *J. agr. Res.*) proved to be more or less susceptible, particularly Champion of England, Phenomenon, and Mammoth Melting Sugar, while Notts Excelsior and Little Marvel were not so severely attacked.

Canonaco (A.). **Un forte attacco di ruggine alla Lentichia ('Lens esculenta' Moench).** [A heavy attack by rust on Lentil (*Lens esculenta* Moench).]—*Riv. Pat. veg.*, xxvii, 9–10, pp. 281–285, 2 figs., 1937.

A brief account is given of a heavy outbreak, in 1937, of rust in an experimental field of lentils in the district of Palermo, where attempts are being made to introduce the commercial cultivation of this crop. By the characters of its uredo- and teleutospores, both of which were found on the lentil plants, the rust is referred to *Uromyces fabae* [*R.A.M.*

xvi, p. 207] which is stated to be very prevalent in Sicily on broad beans [*Vicia faba*]. If lentils are to succeed in Sicily, care should be taken to destroy soon after harvest all dead plants of broad beans, as well as all other hosts of the rust in the field, while applications of sprays during spring may also prove beneficial.

McWhorter (F. P.). **Cell inclusions in Onion yellow dwarf.**—*Phytopathology*, xxvii, 10, pp. 1027–1028, 1 fig., 1937.

The cell inclusions in fuchsin-stained material, fixed in aceto-formalin and mounted in dioxan, of California onion leaves affected by yellow dwarf [*R.A.M.*, xiv, p. 810; xvi, p. 725] were found to present no unusual structures but to consist of minute, rod-like structures enveloped with cytoplasmic trailings. The adjoining nuclei are readily distinguishable by the presence of characteristic reticulate structures reacting with greater intensity to fuchsin stains than the cytoplasm.

Bottomley (A[veril] M.). **Grape anthracnose.**—*Fmg S. Afr.*, xii, 137, pp. 338–339, 2 figs., 1937.

A popular account is given of the symptoms, etiology, and control of grape anthracnose (*Elsinoe ampelina*) [*R.A.M.*, xvi, p. 655], which is stated to be the most serious vine disease in the summer-rainfall areas of South Africa, where all the green organs—berries, leaves, stems, and tendrils—are liable to infection. Moisture and fairly high temperatures are essential for the germination of the spores whereby infection is perpetuated. Good control of *E. ampelina* may be obtained by a dormant application of iron sulphate (25 lb.) and sulphuric acid (1 pint) in water (50 gals.), followed in the spring, if necessary, by further treatments (two or more according to the severity of infection and weather conditions) with 4–4–50 Bordeaux mixture.

Rives (L.). **Nouvelles observations sur les champignons endophytes de la Vigne.** [Further observations on the endophytic fungi of the Vine.]—*Rev. Vitic., Paris*, lxxxvii, 2259, pp. 275–278, 1937.

The author states that his cytological studies of various organs of a number of vine varieties, both healthy and affected with court-noué, in which he strictly adhered to Ranghiano's [*R.A.M.*, xiii, p. 616] methods, have convinced him that the structures interpreted by that investigator as mycelium of an endophytic fungus, are artifacts [cf. ibid., xiv, p. 616]. Endophytic mycelium was observed, however, in the cortical tissues of the rootlets, but not in the other tissues of either healthy or diseased vines.

Gigante (R.). **Ricerche istologiche sulle omeoplasie crestiformi (enations) delle foglie di Vite affette da rachitismo.** [Histological researches on the crestiform homoplasia (enations) of Vine leaves affected with rachitism.]—*Boll. Staz. Pat. veg. Roma*, xvii, 2, pp. 169–192, 1 pl., 14 figs., 1937.

As a result of histological studies on leaf enations in Italian vines showing symptoms of 'rachitism' [regarded by Petri as distinct from 'arriciamento' (or leaf roll) (*R.A.M.*, xvii, p. 95) since no endocellular

cordons were present and the symptoms did not develop throughout the growing season], the author states that the enations start as a slight protuberance on the lower leaf surface due to the division of the subepidermal tissues of the young leaves. This protuberance enlarges, and develops palisade and spongy parenchyma, like a true leaf. Generally the enations develop in pairs, and the palisade tissues of the one may pass directly into the other or there may be transitional cells interposed, the arrangement of the tissues being inverse to that of the leaf bearing them. Sometimes two adjacent excrescences unite at the edges to form a cavity. In the diseased palisade cells a dense cytoplasmic bridge was sometimes observed, apparently continuous with the parietal layer of cytoplasm. Intracellular inclusions were present in the cells of the palisade tissue and those of the woody parenchyma. The author considers that these findings support Petri's view that the disease may be due to a virus, although in recent grafting experiments infection was not transmitted.

Branas (J.), Bernon (G.), & Levadoux (L.). **Note sur la transmission par le sol de la dégénérescence de la Vigne.** [Note on the transmission through soil of degeneration diseases of the Vine.]—*Rev. Vitic., Paris*, lxxxvii, 2258, pp. 263–268, 2 graphs, 1937.

The authors state that their observations at Montpellier [the results of which are tabulated] showed a direct relationship between the number of lesions caused on the roots of two French vine varieties (grafted on a wide range of American and hybrid stocks) by *Phylloxera* [*vastatrix* f. *radicicola*] and the incidence and severity of vine degeneration (comprising diseases known as court-noué, leaf roll [see preceding abstract], Reisigkrankheit [*R.A.M.*, xvi, p. 795], fasciation, and panachure [variegation]). It was further noticed that in mixed lots the removal of vines highly susceptible to *Phylloxera* caused a marked increase in the severity of degeneration symptoms in *Phylloxera*-resistant neighbouring stocks, owing to the migration of the insects to the latter. These findings are considered to suggest that the insect may be a vector of the degeneration diseases [cf. ibid., xiii, p. 492].

Bonnet (A.). **Chronique. La brunissure.** [Current events. 'Brunissure.']—*Progr. agric. vitic.*, cviii, 41, pp. 325–327, 1937.

The author states that in 1937 vineyards in France showed very little, if any, 'brunissure' [*R.A.M.*, xiv, p. 214], except for certain vine varieties in the southern provinces, which yielded heavier crops than the average for that year. The scarcity of the condition is directly correlated with the comparatively light crops of grapes gathered, and this fact supports the views of Ravaz who regarded the disorders as due to the depletion of the potassium in vegetative organs of the vine through overproduction of fruit.

Plant diseases. Notes by the Biological Branch.—*Agric. Gaz. N.S.W.*, xlvii, 11, pp. 624–628, 6 figs., 1937.

Though barley stripe (*Helminthosporium gramineum*) was first observed in New South Wales many years ago in experimental plots it

was not recorded in a commercial crop until September, 1937, when it is stated to have caused damage in the Braidwood district of the State. A brief description is also given of crown rot in ornamental and vegetable crops, commonly caused by *Sclerotium rolfsii*. Many instances of severe loss from this disease have been noted in the past. Heat-treated tobacco dusts used for insect pest control have recently been tested as carriers of tobacco mosaic but were found to be non-infectious.

Noble (R. J.). **Australia: notes on plant diseases recorded in New South Wales for the year ending 30th June, 1937.**—*Int. Bull. Pl. Prot.*, xi, 11, pp. 246–247, 1937.

This report contains the following items in addition to information already noticed from other sources. A severe root and stalk rot of sorghum was caused by a species of *Colletotrichum*, and injury due to *Bacterium holcicola* [*R.A.M.*, xv, p. 280] was also recorded.

Lucerne was affected by witches' broom [ibid., xvi, p. 518] and a disorder apparently identical with dwarf (of virus origin) [ibid., xvi, p. 816], the latter observed for the first time in New South Wales. A witches' broom-like condition also occurred in soy-bean crops. Tomato spotted wilt and 'paper leaf', a disturbance of the spindle tuber type, were observed affecting potatoes. *Septoria depressa* was reported on Navel oranges [ibid., xi, p. 780] in inland irrigation areas. Banana 'squirter' disease (*Nigrospora sphaerica*) [or *N. musae*: ibid., xvi, p. 763] caused loss among fruits consigned to cooler regions.

Manns (T. F.), Davies (F. R.), Heuberger (J. W.), & Adams (J. F.). **Department of Plant Pathology.**—*Rep. Del. agric. Exp. Sta., 1936–7* (*Bull.* 207), pp. 36–45, 1937.

Further work at Delaware on the masking of peach yellows and little peach [*R.A.M.*, xvi, pp. 368, 621] in plums showed that, when the Elberta and natural peach seedlings were budded with material from various species of *Prunus* infected with yellows or little peach, the average percentage of infection with yellows was nearly equal for both hosts (60 and 57·5, respectively), whereas for little peach the figures were 19·7 and 33·8, respectively. The almond readily takes both diseases and certain Oriental plums may bear marked symptoms of them, while in others considerable masking may be present. The wild rootstock used for grafting plum (*P. myrobalana*) [*P. divaricata*] shows nearly complete masking of both conditions. Each virus was easily able to reach nursery plums when infected grafting stock of *P. divaricata* was used, and from these was carried to peaches by *Macropsis trimaculata*.

Typical foliage and twig infection by *Bacterium pruni* [ibid., xvi, p. 369] was noted on *P. othello*.

Seed from watermelons affected with wilt (*Fusarium* [*bulbigenum* var.] *niveum*) [ibid., xvi, pp. 369, 439] showed typical growth of the fungus when planted out after disinfection, confirming the view that infection in the field is seed-borne.

In spraying tests against apple scab [*Venturia inaequalis*] the following all gave greater percentages of clean fruit than Bordeaux mixture 4–8–100: coposil (3–100); Bordeaux 34 (1–100); Z-O (1·5 to 2–100);

copper phosphate, bentonite, and lime (4–4–8–100) [ibid., xvii, p. 193]; and a combination of 1 gal. lime-sulphur and ½ lb. Z-O per 100 gals. water.

The newer tomato varieties Marglobe, Master Marglobe, and Rutgers are more resistant to wilt [*F. bulbigenum* var. *lycopersici*] and early and late blights [*Alternaria solani* and *Phytophthora infestans*, respectively] than the older varieties grown in Delaware.

Brown (Nellie A.) & Gardner (F. E.). **Indoleacetic acid galls of a secondary type.**—*Phytopathology*, xxvii, 11, pp. 1110–1113, 2 figs., 1937.

In addition to the primary galls induced on Kidney bean [*Phaseolus vulgaris*] stems by smearing them with an indoleacetic acid and lanoline mixture [*R.A.M.*, xvi, p. 798], from 1 to 15 secondary galls arose at some distance from the site of application in response to an internal disturbance, possibly connected with a superfluity of growth substance. Crown gall is not usually regarded as a systemic disease because of the apparent absence of *Bacterium tumefaciens* from the tissues adjacent to the galls or from secondary excrescences. It is now evident, however, that the latter are due to the emission by the organism in the primary gall of a gall-stimulating substance which, as the experiments with indoleacetic acid showed, can move through the stem for considerable distances.

Dade (H. A.). **Swollen shoot of Cacao. Report on Mr. H. A. Dade's visit to the Gold Coast.**—*Sess. Pap. legisl. Counc. Gold Coast Colony* No. 5 of *1937*, 15 pp., 1937.

In this detailed, official report of his visit to the Gold Coast to investigate 'swollen shoot' disease of cacao [*R.A.M.*, xvi, p. 518], the author states that the extensive loss of trees in New Juaben and Eastern Akim is due to drought die-back, the result of extreme exposure to sun and wind during the dry season, brought about by the gradual disappearance of shade trees and surrounding forest, the effect of which is enhanced in this district by light, non-retentive soil. Swollen shoot symptoms [loc. cit.] are found, not very profusely, only on trees severely affected by drought die-back, and are merely secondary. They occur freely on the water-shoots which spring from the stumps of felled die-back trees. Sometimes, but not consistently, associated with swollen shoots are somewhat chlorotic, puckered leaves. The swellings are the result of hypertrophied secondary growth of the xylem, but until die-back necrosis supervenes, the tissues are otherwise healthy, and no parasite could be isolated from them. Necrotic die-back tissues, whether accompanied by swollen shoot or not, are always invaded by secondary fungi such as *Botryodiplodia theobromae* and saprophytes such as *Gliocladium roseum*, none of which can attack healthy tissue. The possibility of a virus origin is not excluded, but is thought to be unlikely, and it is considered that the swollen shoot phenomena are more probably due to an undetermined soil deficiency, occasioned by leaching of the soil by heavy rain as exposure increased.

The existing control operations [loc. cit.] were not effective, since the disorder continued to spread, and were aggravating the trouble by

exposing the remaining trees still more. It is therefore recommended that they should be discontinued, and replaced by an intensive programme of replanting of shade trees and windbreaks, to prevent further extension of die-back and to recondition the area, which is a valuable one. The need for re-establishment and maintenance of protection is not confined to the district in question, though most urgent there, but applies in varying degree to all cacao areas, deterioration of the forest being general. It is considered that the life of cacao orchards can be prolonged indefinitely if normal forest conditions are maintained; and notes are given on the material and methods to be employed in the replanting programme. Though others should be tried, *Samanea saman* is probably the most suitable quickly growing tree for shade purposes.

This Minnesota seed grain treater provides means for easily disinfecting seed on the average farm.—*Agric. News Lett.*, v, 9, pp. 154–156, 2 plans, 1937. [Mimeographed.]

A description is given of a seed-grain treater designed by M. B. Moore for use with disinfectant dusts. It consists of a horizontal proportioning trough which fits at or and into a vertical mixing chute with a series of baffle boards each pierced with a 2-in. hole. The apparatus must be mounted high enough for the bottom of the chute to clear the floor by the height of a grain sack, the free end of the trough being supported by a rope and pulley hung from the ceiling. In operating, the proportioning trough is filled with evenly spread grain sprinkled with the necessary quantity of disinfectant dust, then by raising the free end of the trough the grain is shot through the chute into bags.

Hassebrauk (K.). **Untersuchungen über die biologische Spezialisierung von Puccinia graminis tritici (Pers.) Erikss. et Henn. und Puccinia graminis avenae (Pers.) Erikss. et Henn. in Deutschland und Südeuropa.** [Investigations on biologic specialization in *Puccinia graminis tritici* (Pers.) Erikss. & Henn. and *Puccinia graminis avenae* (Pers.) Erikss. & Henn. in Germany and southern Europe.] —*Arb. biol. Anst.* (*Reichsanst.*) *Berl.*, xxii, 1, pp. 65–70, 1937.

Twenty-four wheat black rust (*Puccinia graminis tritici*) collections from Germany, Hungary, U.S.S.R., Bulgaria, Greece, Italy, and Turkey were found to contain the physiologic races 40, 21, 17, 14, 34, and 75, with the addition of a new one, 145, which differed from the rest in its pathogenicity towards the varieties comprised in Stakman and Levine's original standard assortment [*R.A.M.*, ii, p. 158]. Races 40 and 21 were the most widely distributed. A number of collections from all the countries represented were attacked and destroyed by *Verticillium niveostratosum* and *Cephalosporium acremonium* [ibid., xvi, p. 237] before they could be tested on the differential varieties.

One Bulgarian and six German collections of *P. graminis avenae* yielded exclusively physiologic form 6 [ibid., xiii, p. 363].

The results of these studies are considered to support the hypothesis of a causal connexion between outbreaks of *P. graminis* in central and southern Europe.

HASSEBRAUK (K.). **Untersuchungen über die physiologische Spezialisierung von Puccinia triticina Erikss. in Deutschland und einigen anderen europäischen Staaten während der Jahre 1934 und 1935.** [Studies on physiologic specialization in *Puccinia triticina* Erikss. in Germany and some other European countries during the years 1934 and 1935.]—*Arb. biol. Anst.* (*Reichsanst.*) *Berl.*, xxii, 1, pp. 71–89, 1937.

Sixty samples of brown rust of wheat (*Puccinia triticina*), mostly of German origin supplemented by a few from Belgium, Finland, Czechoslovakia, Hungary, Bulgaria, Italy, Greece, and Turkey, yielded physiologic forms [*R.A.M.*, xvi, p. 732] 11, 14, 15, 16, 17, 20 (13), 31, and 68 in 1934, while in 1935 the material comprised, in addition to the foregoing, forms 19, 26, and 53 (68 being absent) and three new ones, herein designated A, B, and C; of these A, occurring sporadically throughout Germany, virulently attacked all the eight varieties of the standard assortment [ibid., xi, p. 288] except Mediterranean, which showed some resistance, B (Breslau and Lübeck) attacked Mediterranean severely and infected four others, and C (Württemberg, once only) was highly pathogenic to Malakoff and infected six others, mostly in a mild form. As in the case of *P. graminis*, a number of samples of *P. triticina* were destroyed by *Verticillium niveostratosum* [see preceding abstract] before they could be tested.

The most widely distributed of the foregoing races in Germany were 11, 14, 16, and 20 (with which Scheibe's 13 [ibid., viii, p. 366] is considered to be identical); besides A, B, and C, races 26, 31, 53, and 68 were detected for the first time in Germany and constitute new records for the European continent, while races 18, 21, and 22 did not occur during the period under review. The physiologic races were distributed among the foreign collections of *P. triticina* as follows: 11 and 16 in Belgium, 11 and 20 in Finland, 15 and 20 in Czechoslovakia, 11, 15, and 20 in Hungary, 14, 17, and 20 in Bulgaria, 11, 14, 15, and 20 in Italy, 14 and 20 in Greece, and 11, 14, 15, 18, 19, 20, 25, and 31 in Turkey. It is apparent from a study of previous observations on the composition of the brown rust races in Germany that a change has taken place of recent years, the outstanding features of which are the great increase in the prevalence of the formerly sporadic 16 and the simultaneous marked decline in the incidence of 15. The results of the present investigations lend no support to Scheibe's theory [ibid., ix, p. 767] that definite laws govern the geographical distribution of the brown rust races in Germany and probably elsewhere in Europe. On the contrary, the qualitative and quantitative composition of the race flora of a given region must be expected to undergo periodical alterations in response to varying meteorological conditions, the cultivation of predominantly resistant or susceptible varieties, and the incalculable development of new mutant races.

There has, in the writer's opinion, been a tendency of late years to create new races of *P. triticina* on inadequate grounds, many of those described showing no well-defined differential pathogenicity towards the standard varieties and merely confusing the main issues from the plant-breeder's standpoint, which in a matter of this kind should outweigh purely systematic interests.

In an appendix attention is briefly directed to some recent Russian contributions to the subject of brown rust specialization [ibid., xvi, p. 163] appearing while the present work was in the press.

Sibilia (C.). **Esperienze di lotta diretta contro le ruggini del Grano con 'Asporital' d'Amico nel 1937.** [Experiments on the direct control of Wheat rusts with d'Amico's 'asporital' in 1937.]—*Boll. Staz. Pat. veg. Roma*, N.S., xvii, 2, pp. 267–272, 1 fig., 1937.

Villa Gloria wheat near Alessandria dusted during the second week of May, 1937, before the appearance of *Puccinia glumarum*, with a copper dust 'asporital' subsequently had a 'specific weight' [weight of the grain per hectol.] of 77 kg., as against one of 72 kg. for the untreated control. No observations could be made on the fungicidal value of the dust as the experiment was interrupted by adverse weather conditions.

In another locality, 13,270 sq. m. of Virgilio wheat were dusted with the same preparation (by one man using a hand dusting machine) on 25th April, 10th and 22nd May, and 5th June, 43,330 sq. m. remaining untreated as a control. The dusted wheat showed practically no infection, and yielded 23·37 q. of grain per hect. of specific weight 79·1 kg. (average); the untreated wheat showed slight but well-marked infection by *P. graminis*, *P. triticina*, and *P. glumarum* and yielded only 20 q. of grain per hect. of specific weight 78·3 kg. Allowing for the cost of material and labour, the treatment gave a net profit of 439·25 lire per hect.

Nelson (O. A.) & Leukel (R. W.). **Experiments with certain copper compounds as bunt fungicides.**—*Circ. U.S. Dep. Agric.* 452, 8 pp., 1937.

Tabulated results are given of field tests (following preliminary laboratory tests) of a number of copper compounds in the control of bunt (*Tilletia tritici* and *T. levis*) [*T. caries* and *T. foetens*] carried out during the period 1930–5. Copper carbonate was used as a standard of comparison. Basic copper sulphate, high-grade copper carbonate, copper sulphate-aniline (containing 20·6 per cent. copper and prepared by adding aniline to a solution of copper sulphate) and possibly copper chloride-aniline (prepared by adding aniline to a solution of cupric chloride until no more aniline reacted) were found in general to be superior to all other copper compounds tested as regards cost, efficiency, and freedom from objectionable characters. Copper oxychloride besides being somewhat corrosive to metal is slightly less efficient than copper carbonate, the phosphate and silicate were not consistently effective, dehydrated copper sulphate and copper sulphate monohydrate were effective when finely powdered but became lumpy from moisture absorption, while cupric oxide was inferior to the carbonate, and cuprous oxide though effective is more abrasive. Basic copper sulphate besides being somewhat cheaper than the carbonate is apparently equal or even superior to it in effectiveness. A proprietary dust containing 5 per cent. of ethyl mercuric phosphate was as good as any of the copper dusts tested.

Voss (J.). **Zur Methodik der Prüfung von Weizensorten auf ihre Widerstandsfähigkeit gegen Steinbrand (Tilletia tritici).** [On the technique of testing Wheat varieties for their resistance to bunt (*Tilletia tritici*).]—*Pflanzenbau*, xiv, 4, pp. 113–153, 3 figs., 5 maps, 1937.

Particulars are given of two new methods, applicable, respectively, to summer and winter wheats, for the testing of varietal reactions to bunt (*Tilletia tritici*) [*T. caries*] in the greenhouse in relatively short periods, six to eight weeks in the case of summer varieties and about twice as long for winter ones. The varying degrees of pathogenicity of the several collections of the fungus can also be detected by means of the greenhouse technique, which has been used for three years at the Biological Institute, Berlin-Dahlem, side by side with the customary field tests.

The summer wheat seed-grain, mixed with 0·3 to 0·5 per cent. by weight of inoculum, is placed in pots containing 2 parts of sand and 1 of loam, with the addition of 500 gm. lightly moistened peat mould per 10 kg. of soil mixture, and various fertilizers. A temperature of 16° to 17° C. has generally been found most suitable for germination, after which the pots are kept at 20°, rising to 28° at times during the summer. The plants are watered twice a week with 1 per cent. hakaphos. From dusk till 5 a.m. the plants are irradiated with Nitra incandescent lamps (350 watt per sq. m.) suspended above them.

The winter wheat seed-grain is inoculated with 0·5 per cent. bunt spores of varying origin, germinated in a cellar at 10·5°, transferred to daylight at 10° to 13°, and then after ten days placed in a refrigerator (2·4° to 5·8°) to induce flowering before removal to the greenhouse.

Generally speaking, the infection percentages in summer wheat were higher in the greenhouse than in the field, whereas in the case of the winter varieties the figures were roughly parallel. In agreement with previous workers, the writer found a high degree of resistance in the summer varieties Ohio, Garnet, and Hope, and also in Heine's selection of *Triticum durum*; Peragis was highly susceptible (100 per cent. infection) and a number of other varieties intermediate in their reaction. Among the winter wheats General von Stocken proved to be highly susceptible (90·7 per cent. infection), while varying degrees of resistance were shown by Heil's Dickkopf, Hohenheimer 77, and the two new selections 827/35 and 828/35.

The bunt collections from different localities varied in their pathogenicity towards the wheats used in the tests, attack by that from Harleshausen, for instance, being generally mild while the Breslau, Hamburg, Munich, and Stettin strains caused heavier infection.

Millikan (C. R.) & Sims (H. J.). **The reactions of Wheat varieties to flag smut.**—*J. Dep. Agric. Vict.*, xxxv, 10, pp. 514–520, 4 figs., 1937.

The losses caused by flag smut of wheat (*Urocystis tritici*) in Victoria [*R.A.M.*, xvi, p. 664] are stated to have declined appreciably of recent years owing to the extended use of resistant varieties. From 1931 to 1936 varietal reaction trials were held, using the susceptible Free Gallipoli as a check and calculating all results on a comparative basis

of 100 per cent. infection in this variety. Standard errors were computed separately for the susceptible (50 per cent. infection or over) and resistant (under 50 per cent.) groups. This method indicated the very low significance of a single result, especially in the case of susceptible varieties. The following varieties, besides a number of Ghurka and Rajah and Gallipoli hybrids, were found to be resistant: Dindaloa, Red Rock, Nabawa, Cedar, Geeralying, Carrabin, Sutton, Florence, Forward, Dan, Sunset, Bencubbin, Dundee, Sword, Ghurka and its selections 228T and (W595, 05), Telfords, and Totadgin. In this connexion it is of interest to note that certain selections of the resistant variety Ghurka (susceptibility figure 17) are very susceptible (103 and 76). Full details are given of a series of inoculation experiments, the outcome of which definitely confirmed previous observations as to the occurrence of suppressed infection in semi-resistant varieties, occasioning heavier losses than external symptoms would denote. Early and deep sowing was found to favour infection by *U. tritici*, as well as the use of a heavy spore load (1 per cent.) for the inoculum.

Samuel (G.) & Greaney (F. J.). **Some observations on the occurrence of Fusarium culmorum on Wheat.**—*Trans. Brit. mycol. Soc.*, xxi, 1–2, pp. 114–117, 1937.

Fusarium culmorum [*R.A.M.*, xvi, p. 308] was found about harvest time in 1934 to be present at the Rothamsted Experimental Station on the roots and bases both of healthy wheat plants and of those affected with whiteheads (*Ophiobolus graminis*) [ibid., xvi, p. 736], and periodic observations were accordingly made in 1935 at Rothamsted, St. Albans, and Cambridge on the progressive invasion of the roots and crowns of wheat plants by fungi from blossoming to maturity. The crops in all the three experimental fields were among the healthiest in the respective districts and gave no indication of having suffered from seedling diseases, but *F. culmorum* was isolated from a few specimens in every field at the time of the first sampling. While at Rothamsted the incidence of the fungus decreased as the season advanced, in the other two fields it increased markedly, until just before harvest 70 per cent. of the plants examined showed its presence on stem base or roots. The same percentage of infection was found in the stubble at St. Albans two weeks after harvest, while at Cambridge it was present in every one of 50 random stubble samples taken three weeks after harvest. The crops, nevertheless, gave excellent yields, and the grain at Cambridge filled remarkably well. The average disease ratings, obtained in greenhouse tests of the pathogenicity to wheat seedlings of the strains of *F. culmorum* from the three fields, were 21 (ranging from 9 to 40) for the 13 isolates of *F. culmorum*, 99 for three isolates of *O. graminis*, and 7·5 for the controls.

The fact that, although evidently present in the soil of the three fields, *F. culmorum* did not exert an appreciable parasitic effect on the wheat plants, is in contrast to the fairly frequent reports, especially from the north of England, of appreciable damage caused by it to the crops; it may be significant that in all three fields, in which it caused no apparent injury, the soil is a slightly alkaline clay.

Garrett (S. D.). **Soil conditions and the take-all disease of Wheat. II. The relation between soil reaction and soil aeration.**—*Ann. appl. Biol.*, xxiv, 4, pp. 747–751, 1937.

An account is given of experiments, the results of which showed that the retarding effect of high soil acidity on the growth of *Ophiobolus graminis* along the roots of wheat seedlings [see preceding abstract and *R.A.M.*, xvi, p. 306] is almost completely neutralized by forced aeration of the soil. In soil adjusted to P_H 5·9 the fungus made a growth along the seedling roots of 8±1·8 mm. in 14 days, whereas in the same soil subjected to forced aeration it grew 31±3·4 mm., as compared with 35±3·1 mm. in aerated soil adjusted to P_H 8. Comparable results were also obtained in two other series of tests, in one of which the experiments were made with two field soils both with P_H 5·2 and a third one with P_H 8, the figures for the non-aerated soils being 5, 6, and 18 mm. respectively, and for the aerated 22, 26, and 23 mm. respectively. These findings support the suggestion made in the first paper of this series [loc. cit.] that the retardation of the growth of *O. graminis* along the host roots in acid soils is due to the accumulation in the latter of respiratory carbon dioxide.

Young (P. A.). **Sclerotium blight of Wheat.**—*Phytopathology*. xxvii, 11, pp. 1113–1118, 2 figs., 1937.

From 1928 to 1935 *Sclerotium fulvum* destroyed a minimum of 100 to 500 acres of wheat annually in Gallatin County, Montana [*R.A.M.*, xiii, p. 434], except in 1934, when the snow with which the fungus is normally associated was almost absent. In 1931–2 the following were among the varieties killed by the fungus: Albit, Cooperatorka, Fulcaster, Harvest Queen, Hussar, Kanred, Kawvale, Malakoff, Marquis, Mediterranean, Minhardi, Oro, Regal, Ridit, Sherman, and Turkey. Maize-meal agar cultures of *S. fulvum* grew only at temperatures near 0° to 5° C., a fact that explains the above-mentioned correlation between the development of sclerotial blight and the snow banks providing the requisite temperature and moisture conditions. Basidial formation, on the basis of which the species under discussion has been referred to *Typhula graminum* [ibid., xiv, p. 568], did not occur in the writer's experiments with sclerotia from wheat tissues and agar cultures, so the name *S. fulvum* is retained for the present. Turkey wheat covering nearly 20 out of 100 acres was destroyed by sclerotial blight in 1935, when *Thlaspi arvense* was also killed over a large wheat area. The fungus overwinters on wheat stubble and dead stems of *Sisymbrium altissimum* and *Chenopodium album*; volunteer wheat seedlings springing up in the vicinity were commonly found to be severely attacked by blight, showing *Sclerotium fulvum* to be a facultative parasite that increased abundantly as a saprophyte.

Straib (W.). **Die Bestimmung der physiologischen Rassen des Gerstenzwergrostes, Puccinia simplex (Kcke) Erikss. et Henn.** [The determination of the physiologic races of Barley dwarf rust, *Puccinia simplex* (Körn.) Erikss. & Henn.]—*Arb. biol. Anst.* (*Reichsanst.*) *Berl.*, xxii, 1, pp. 43–63, 1937.

A standard assortment consisting of ten barley varieties was used

for the determination of 14 physiologic races from 124 collections of dwarf rust (*Puccinia simplex*) [*P. anomala*] made during 1934–5, mostly in Germany [*R.A.M.*, xiv, p. 624] with a few from Holland, Sweden, France, and Turkey. The varieties were Grossklappige, Friedrichswerth Berg, Ackermann's Bavaria, Australian Recka, Egyptian four-rowed, Cruzat, Quinn C.I. 1024, Chilean D (C.I. 1433), Australian two-rowed, and Cuban. Ten of the 14 races were found to be new, while five collected by Hey, making a total of 19, were absent from the present series. The temperature selected as most suitable for the purpose in view was 16° C., at which the differential symptoms induced on the test varieties by the several physiologic races were most conspicuous, especially in the case of the more or less resistant varieties. The races seem to be distributed irregularly; though some are of more frequent occurrence than others, the latter may cause equally heavy damage by reason of their widely extended range.

Discussing the results of his experiments in relation to the practical problem of breeding barley for resistance to dwarf rust, the writer points out that the marked resistance of the Friedrichswerth, Berg (winter), and Bavaria (summer) varieties to a number of races is largely nullified by their susceptibility to others of wide distribution. The following four-rowed types, however, might be tested as parents in selection trials: JLB No. 3036 Spanish, JLB No. 3041 Palestine (both *Hordeum tetrastichum coerulescens*), and JLB No. 3119 Weider C.I. 1020 (*H. tetrastichum pallidum*), while Quinn C.I. 1024, Bolivia C.I. 1527, Peruvian C.I. 935, Callas C.I. 2440, Mecknos Moroc C.I. 1379, and Juliaca C.I. 1114 showed resistance to rust both in Mains's [ibid., x, p. 231] and the writer's experiments.

Straib (W.). **Untersuchungen über das Vorkommen physiologischer Rassen des Gelbrostes (Puccinia glumarum) in den Jahren 1935/36 und über die Agressivität einiger neuer Formen auf Getreide und Gräsern. Mit einer Nachschrift 'Unterschiede in der Keimungsweise der Uredosporen physiologischer Rassen von Puccinia glumarum'.** [Studies on the occurrence of physiologic races of yellow rust (*Puccinia glumarum*) in the years 1935–6 and on the aggressiveness of certain new forms on cereals and grasses. With a postscript: 'Differences in the mode of germination of the uredospores of physiologic races of *Puccinia glumarum*'.]—*Arb. biol. Anst.* (*Reichsanst.*) *Berl.*, xxii, 1, pp. 91–119, 1937.

By means of the cultivation of a yellow rust (*Puccinia glumarum*) 'indicator', Michigan Amber wheat, in various places in Germany and collections from other varieties and hosts, the author has surveyed the physiologic races of the rust occurring in the country and their geographical distribution [*R.A.M.*, xvi, p. 372], with special reference to barley.

Fifteen yellow rust races were differentiated in 1935 and eight in 1936 out of a total of 222 collections from widely separated localities; among these four were new. Seventy-three samples of foreign material from 32 places yielded 18 races during the two years. Up to the present 38 physiologic races of *P. glumarum* have been isolated and described, of which 20 are found in Germany. A key is furnished showing their

differential behaviour on a standard assortment of wheat varieties, two of barley (Heil's Franken and Fong Tien), one of rye (Petkus), *Hordeum murinum*, and *Agropyron repens*. Certain races tend to predominate in different countries. On wheat in Germany, for instance, race 7 is by far the most prevalent, followed at a considerable distance by 3, 5, and 8, whereas 18 and 20 are characteristic of the Balkans, and 2 and 3 of France and Belgium. Race 8 appears to be indigenous to Sweden. On barley in Germany only race 23 could be detected, the same one occurring also in Holland, Hungary, Bulgaria, and Turkey on this host. In France, however, barley is attacked by race 24.

Among the new races encountered in 1935–6 were three (28, 33, and 34) capable of infecting *A. repens*, *H. murinum*, and rye, respectively, and a non-specific form, 36. These races were virtually innocuous to German cultivated wheats but attacked a number of *Triticum* spp. with varying severity. On the other hand, most of the 152 German winter wheats tested were highly susceptible to two other new races, 26 and 27 (resembling race 7), while the 30 summer varieties showed moderate resistance. The South American race 30 was only slightly pathogenic to most of the German wheats. Some 500 German and foreign barleys were tested for their reaction to races 28, 33, 34, and 36, and like the wheats were uniformly immune or highly resistant. A number of other *Hordeum* species, however, reacted positively to inoculation with 28 and 33. Race 36 caused moderate infection on a number of *H.* spp. but 34 (rye) was only mildly pathogenic. Race 30 was somewhat more active in its attacks on German commercial barleys than on the wheats used in the tests. All the 37 rye varieties inoculated with race 34 proved to be highly susceptible, whereas they were immune from, or highly resistant to, 28 and 33. Races 28, 33, and 36 were tested for their pathogenicity to a number of wild grasses, of which some were attacked by all three, while various species of *Bromus* were immune from, or highly resistant to, each of the races. The grass range of the *A. repens* race 28 would appear to be scarcely wider than that of certain wheat and barley forms.

The occurrence on rye, *A. repens*, and *H. murinum* of specific races of *P. glumarum* is of considerable importance from the standpoint of geneticists and plant-breeders, inasmuch as these species are scarcely likely to serve any useful purpose in hybridization experiments. The same applies to *Haynaldia villosa* [*A. villosum*], which contracted moderately severe infection on inoculation with race 28. In this connexion it should also be noted that the *A. repens* and rye races, though unable to infect German wheats and barleys, are highly pathogenic to the American Kanred wheat. Caution in the use of foreign varieties for crossing is therefore indicated.

In culture on 2 per cent. agar the uredospores of race 2 germinated rather slowly, its maximum temperature being 23° C., while the corresponding figures for 9 and for 12 and 20 were 25° and 27°, respectively. At the optimum temperature of 12° race 23 germinated fairly rapidly, the process generally being completed in four hours; the maximum for this race is 27°. Similar relationships obtain in the case of 24 and 28, with a slightly lower temperature maximum. The germ-tubes of race 23 present a curly aspect, in contrast to the normal nearly straight

yellow rust type. A similar corkscrew appearance is exhibited by races 24 and 28 and in a less pronounced form by certain wheat forms. The germ-tubes of races 23, 24, and 28 disintegrate at an early stage. Germination tests may thus afford a supplementary method of distinguishing yellow rust races.

Smith (N. J. G.). **Leaf-scald of Barley in South Africa.**—*S. Afr. J. Sci.*, xxxiv, pp. 286–290, 1 fig., 1937.

An account is given of barley leaf blotch (*Rhynchosporium secalis*) [*R.A.M.*, xvii, p. 22], as it was found by the author to occur in a number of localities in the Cape Province, ranging from Stellenbosch to north of Grahamstown, at altitudes from near sea-level to well above 4,000 ft., this being the first record of the disease from South Africa. The fungus has not yet been found on wild grasses, and it is believed to be carried over from season to season by living barley plants which are to be found throughout the year; it was also observed causing conspicuous infection (not previously recorded) on the chaffs of barley grains, similar to those on the leaves, and even where there are no blotches on the chaffs small infections or spores present on the grain apparently serve as a source of infection for the new crop.

Straib (W.). **Die Bestimmung der physiologischen Rassen von Puccinia coronata Cda auf Hafer in Deutschland.** [The determination of the physiologic races of *Puccinia coronata* Cda on Oats in Germany.] —*Arb. biol. Anst.* (*Reichsanst.*) *Berl.*, xxii, 1, pp. 121–157, 1937.

Neither Frenzel's [*R.A.M.*, ix, p. 770] nor Murphy's [ibid., xiv, p. 435] standard assortment of oat varieties for the determination of physiologic specialization in *Puccinia coronata* [*P. lolii*: ibid., xvii, p. 24] having proved entirely adequate for the purpose, a new selection was adopted embodying some of the varieties used by each of these workers with the addition of four, *Avena sativa gigantea*, *A. fatua*, *A. strigosa*, and Uruguay (*A. byzantina*), raised at the Gliesmarode (Brunswick) Experiment Station.

Twenty-six collections of the aecidial stage of the rust from *Rhamnus frangula* failed to infect any of the oat varieties inoculated; of 21 from *R. cathartica* two attacked v. Lochow's yellow oats normally and this species further yielded a race of *P. lolii* non-specific for *A. sativa*. A race with similar infective capacities was also isolated from *R. asplenifolia*. From 144 collections of the uredo stage of *P. lolii* in 104 localities on *A. sativa* and *A. fatua*, 139 physiologic races were isolated in addition to the three from *R. cathartica*.

Temperature relations were found to play an important part in the development of crown rust. Physiological race determination trials are best conducted at 18° C., at which point the differences in reaction of the standard varieties are most clearly expressed, but resistance tests should also be made at a higher and lower temperature range. A marked tendency to enhanced susceptibility was observed at 23° to 25°. Practically all the 320 varieties of oats used in the tests proved to be susceptible to the several races with which they were inoculated, as also were most of the other *A.* spp. included, so that there is little hope of discovering resistant forms. *A. fatua* serves as a reservoir of crown

rust inoculum, harbouring races specific and non-specific for oats. There was very little difference between these two groups in respect of their pathogenicity to wild grasses, and Eriksson's and Klebahn's special forms cannot be maintained. Furthermore, on the ground of experimental results obtained by American workers and also on morphological grounds, as well on the basis of their host range on grasses, the author concludes that the separation of *P. coronata* Corda into *P. coronata* (Cda) Kleb. and *P. coronifera* Kleb. is untenable [loc. cit.].

Further tests (described and tabulated in an appendix) confirmed the results of previous observations as to the relative unimportance of *R.* spp. (other than *R. cathartica*) in the epidemiology of crown rust of oats. *R. frangula* harbours races that are not specifically aggressive towards cultivated oats but may attack them on occasion, and the same applies to *R. asplenifolia* and *R. tinctoria*.

Straib (W.). **Flughafer als Zwischenträger des Kronenrostes.** [Wild Oats as an alternate host of crown rust.]—*NachrBl. dtsch. PflSch-Dienst*, xvii, 11, p. 89, 1937.

Attention is drawn to the widespread occurrence of wild oats (*Avena fatua*) heavily infected by crown rust (*Puccinia coronata*) [*P. lolii*: see preceding abstract] in the beet and potato fields of south Germany and other parts of the country in 1936 and 1937. The plant acts as a reservoir of infection and constitutes a serious menace to the autumn green fodder oats crop, so that measures for its eradication are urgently indicated.

Reed (G. M.) & Stanton (T. R.). **Inheritance of resistance to loose and covered smuts in Oat hybrids.**—*J. Amer. Soc. Agron.*, xxix, 9, pp. 997–1006, 1937.

In two crosses between oat varieties (Victor × Seizure and Victor × Scottish Chief, respectively) in which both parents were susceptible to loose smut (*Ustilago avenae*) [*R.A.M.*, xvii, p. 24], a high degree of susceptibility was obtained in both the F_2 and F_3 generations. The variety Victor was susceptible to covered smut (*U. levis*) [*U. kolleri*] while the other parents were resistant, and the F_2 and F_3 data indicate a monohybrid inheritance for resistance to this disease.

In five crosses in which one common parent, Monarch, was susceptible to covered smut and resistant to loose smut, while in the others (Gothland, Rossman, Danish, Seizure, and Scottish Chief) the relationship was reversed, the F_3 data clearly denote an independent inheritance of resistance to the two diseases, probably controlled by distinct single factors.

In a further cross between Danish Island and Monarch, the former very susceptible to *U. avenae* and slightly so to *U. kolleri*, a single-factor relationship for resistance to loose smut, with resistance dominant, was also indicated. In the case of covered smut, however, susceptibility apparently predominated.

Brandwein (P. F.). **Experiments on latent infection of resistant varieties by the loose and covered smut of Oats.**—*Bull. Torrey bot. Cl.*, lxiv, pp. 433–444, 1937.

Under controlled conditions in the greenhouse and in the field

experiments were carried out on the Black Mesdag, Markton, Scottish Chief, Early Champion, Gothland, and Monarch varieties of *Avena sativa*, the Fulghum variety of *A. byzantina*, as well as on strains of *A. strigosa* and *A. brevis* to test the hypothesis that covered smut (*Ustilago levis*) [*U. kolleri*: *R.A.M.*, xiv, p. 436] and loose smut (*U. avenae*) [ibid., x, p. 722], present as non-sporulating infection, may affect resistant varieties. Plants of such varieties raised from seeds previously dehulled and examined for injury, when inoculated with physiologic races of the smuts to which they were resistant, were not affected either in their yield, height, or number of culms, nor was there any difference in the dates of heading and ripening. Cytological investigations on inoculated resistant plants showed that the mycelium does not penetrate farther than the coleoptile and has no inhibiting effect on growth, whereas in the susceptible varieties it penetrates rapidly to the growing point.

Leitzke (B.). **Infektionsversuche mit Haferflugbrand-Sporen-Gemischen.** [Inoculation experiments with spore mixtures of loose smut of Oats.]—*Phytopath. Z.*, x, 5, pp. 504–553, 4 figs., 1937.

This is an exhaustive, tabulated account of the writer's inoculation experiments on ten standard oat varieties with spore mixtures of six collections of loose smut (*Ustilago avenae*) [*R.A.M.*, xv, p. 354], of which 1, 4, and 5 originated in Minnesota, 2 on *Avena fatua* (Halle), and 3 and 6 on white oats. Collection 1 attacked only the Eckendorf variety, 2 Eckendorf and Petkus, 3 Eckendorf and Gopher, 4 Eckendorf, Petkus, and Gopher, 5 Eckendorf, Gopher, and Lischow Early, and 6 Eckendorf, Petkus, Gopher, and Lischow Early.

The use of mixed inoculum produced the most divergent results. In 55 out of 145 cases there was no modification of pathogenicity, the incidence of infection being as high as that obtained with single inoculations with the most virulent strain. In 44 instances there was no immediate change in pathogenicity, but inoculations with the mixed progeny resulted in a decline of infection. This was already apparent at the outset of the inoculations in a further 18 cases, the decrease being maintained or even intensified in tests with the mixed progenies. In 9 instances a low incidence or absence of infection at the first inoculation was subsequently followed by a rise. Mixed inoculations resulted in an immediate increase of infection, succeeded by a decline in 10 cases, and in 5 the original increase was maintained. Only in 4 cases did infection result from inoculation with mixtures of strains which were individually non-pathogenic, the virulence thus acquired being maintained or intensified in the mixed progenies.

Among the factors involved in these changes in pathogenicity may be mentioned the variable mode of inheritance of aggressiveness, the redistribution of the proportion of aggressive forms by the crossing of spores of high and low degrees of virulence, the development through hybridization of new combinations with fresh faculties for pathogenicity, the mode of reproduction of the fungus, the varying numbers of spores of divergent germinative capacity participating in the mixtures, and the stronger or weaker tendency to sporidial fusion and differing mycelial growth rates. From a study of monosporidial lines isolated

from mixtures of the above-mentioned collections of *U. avenae*, the latter would appear to represent a blend of physiologically distinct races with predominantly heterozygous spores.

In supplementary inoculation experiments 35 new collections were tested on 14 varieties for pathogenicity, which was found to be mostly of a mild order. No correlation could be discerned between the locality of origin of the collections and their infectivity. The Buddha variety showed a high degree of resistance in tests in 1935 and 1936, and may be used as a parent in the breeding of smut-free forms.

The following are among the practical considerations arising out of these studies. The testing of selected oat lines for resistance to *U. avenae* must not be conducted solely with spore mixtures owing to the possibility of reduced infection from these sources. It is recommended that oat populations should be inoculated, as heretofore, with spore mixtures, and the selected lines inoculated singly with highly aggressive strains of the smut, those remaining immune in this test being further subjected to inoculation with a virulent spore mixture.

RADEMACHER (B.). **Kupfergehalt, Kupferbedarf und Kupferaneignungsvermögen verschiedener Hafersorten als Grundlage für die Züchtung gegen die Heidemoorkrankheit widerstandsfähiger Sorten.** [The copper content, copper requirement, and assimilation capacity for copper of different varieties of Oats as a basis for the breeding of varieties resistant to the reclamation disease.]—*Z. PflKrankh.*, xlvii, 11, pp. 545–560, 1 fig., 1937.

The author tested 231 varieties of oats at the Bonn Phytopathological Institute, Germany, in order to establish their resistance to the reclamation disease and found a group of early ripening black moor oats, grown on copper-deficient soils in the north-west of Europe [*R.A.M.*, xvii, p. 104], to be specially resistant.

Experiments were carried out with Probstei, Mahndorf, Victoria white II, von Lochow's yellow (susceptible), and Rotenburg, Dutch Black President, and *Avena strigosa* (resistant) on normal and various types of copper-containing soils over a period of two years. It was found that the susceptible varieties on normal soils never showed a higher copper content than the resistant. On the contrary, the latter show a greater copper content than the former. Results obtained under extremely variable conditions showed that the normal copper content varies in varieties of *A. sativa* from 3·06 to 7·26 mg. in straw and 4·19 to 14·17 mg. in grain per kg. dry substance and in *A. strigosa* from 5·73 to 9·46 mg. in straw and from 8·79 to 12·26 mg. in grain. But whereas the differences in copper content between grain and straw are small in the susceptible varieties, they are considerable in the resistant ones and *A. strigosa*, the latter having a greater capacity for storing copper in the grain than the former. It is concluded that differences in resistance cannot be explained by variations in the copper requirements of the varieties. The results of several pot experiments showed rather that the resistant varieties are able to extract larger quantities of copper from copper-deficient soil than the susceptible varieties—0·127 mg. and 0·0387 mg. per pot, respectively. It appears, therefore, that it is the greater capacity for assimilation of copper in

certain varieties of *A. sativa* and in *A. strigosa* which is responsible for their resistance to the reclamation disease. The copper content is a specific, heritable varietal character and the recognition of the importance of the capacity for copper assimilation should prove of value in the breeding of resistant varieties.

Fleischmann (R.). **Einige Erfahrungen über Maisbrand in Ungarn.** [Some observations on Maize smut in Hungary.]—*Pflanzenbau*, xiv, 5, pp. 199–206, 1937.

The writer's protracted observations on maize smut [*Ustilago zeae*] in Hungary [*R.A.M.*, xvii, p. 174] have shown that destructive attacks on the cobs are comparatively rare, occurring in general in only 2 to 5 cases out of 1,000. Infection of the tassels is more prevalent. In years of heavy smut incidence, however, the figures for cob infection may be considerably higher; in 1937, for instance, the following counts were made per 1,000 plants: tassels 20, cobs 17, other organs 16. Interspersed among these rows were others in which the plants had been wounded by detasselling: infection counts showed that, out of 1,000 plants, 120 had been invaded at the site of the tassels, 30 through the cobs, and 70 through other parts. It is apparent, therefore, that the presence of open wounds, such as those inflicted by heavy summer thunderstorms, increases the likelihood of infection by five to six times [*R.A.M.*, xvi, p. 739]. Another factor contributing to severe smut infection is over-nutrition, especially with stable manure. The examination, in July, 1919, of maize stands of the same variety on rich and poor soil revealed a smut incidence of 106 and 21 per mille, respectively. In July, 1937, the number of diseased plants in black clay sand rich in humus ranged from 72 to 94 per 1,000, the corresponding figures for a light pale sand deficient in humus being 62 to 74.

In 1919 an attempt was made to combat the disease by the excision of the smut boils, 100 of which were carefully removed from 1,000 plants on 30th July. By 13th August 87 fresh boils had developed at the site of operation. In a test on particularly susceptible varieties the average percentage of *U. zeae* on 22nd July was 27·5 per cent.; all the boils were excised on that day and by 2nd August 32·7 per cent. of new ones had developed. It is thus evident that repeated excisions are necessary to keep the disease under control. In the case of tassel infections the results were more satisfactory, the single operation effecting a reduction from 15·5 on 22nd July to 7·8 per cent. after ten days.

Over a sequence of years periods of severe and mild smut infection may be distinguished, the averages for 1921–5, 1926–30, and 1931–5, for instance, being 102, 56, and 35 per mille. In 1936 the figure suddenly rose to 126 and in 1937 it amounted to between 70 and 80 as early as August. The average yields for 1921–5, 1926–30, and 1931–5 were, respectively, 127, 184, and 137 gm. of seed-grain per plant.

In a varietal trial in 1937 the incidence of *U. zeae* in Teneriffe maize was 666 per mille, whereas a new American selection remained completely immune. The results of previous tests (1927–9) also indicated the existence of consistent differences in varietal reaction to maize smut which were transmitted from year to year to the progeny. The record for susceptibility under local conditions is held by teosinte (*Euchlaena*

mexicana), regarded as the ancestor of maize, with 960 per mille infections, which affords a constant supply of inoculum.

The practicability of the control measures suggested by these observations is briefly discussed.

KINSEL (KATHERINE). **Carbohydrate utilization by the Corn Diplodias.**—*Phytopathology*, xxvii, 11, pp. 1119–1120, 1937.

A comparative study was made of the growth of two agents of maize ear rot, *Diplodia zeae* and *D. macrospora* [*R.A.M.*, xiv, p. 564], the latter known only from the south-eastern United States, Brazil, and Africa, on a modified Richards's solution with a number of different compounds as sources of carbon. *D. zeae* was found to make much more extensive growth than *D. macrospora* when the source of carbon was peptone, starch, lactose, maltose, sucrose, or combined sucrose and glucose, while the latter fungus was entirely unable to utilize three brands of glucose, cerulose, fructose (with or without glucose), galactose, and arabinose, on all of which the former developed more or less abundantly. The feeble growth of *D. macrospora* on culture media, such as potato dextrose, maize meal, and bean pod agars, as well as its incapacity to compete with *D. zeae* as a maize ear parasite, may thus be attributable to its inability to utilize the available sources of carbon.

WELLHAUSEN (F. J.). **Effect of the genetic constitution of the host on the virulence of Phytomonas stewarti.**—*Phytopathology*, xxvii, 11, pp. 1070–1089, 5 figs., 1 graph, 1937.

The effect of successive passages through resistant and susceptible hosts on the virulence of *Phytomonas* [*Aplanobacter*] *stewarti* was studied [*R.A.M.*, xiv, p. 751]. Strains of the organism were passed successively through seedlings of a highly resistant (yellow dent inbred, OSF), a highly susceptible (yellow, sweet Golden Bantam GB797), a very susceptible variety of teosinte [*Euchlaena mexicana*: ibid., xv, p. 573], and a series of grasses unrelated to maize.

Up to a certain point, presumably representing an equilibrium between the parasite and its particular host environment, successive passages through the highly resistant maize host increased the virulence of the initial strains for maize, whereas the same procedure in the case of the susceptible maize host decreased the virulence of the pathogen. Successive passages through the susceptible *E. mexicana* variety produced an effect comparable with that obtained by passage through the susceptible maize host, virulence being diminished both in respect of teosinte and maize. Successive passages through such highly resistant hosts, unrelated to maize, as Reed canary grass (*Phalaris arundinacea*), timothy (*Phleum pratense*), tall meadow oat grass (*Arrhenatherum elatius*), and proso or broomcorn millet (*Panicum miliaceum*), reduced the virulence of the bacterial wilt organism towards maize while increasing it in respect of the various grasses.

Cultures of *Aplanobacter stewarti* highly pathogenic to maize were very slimy or watery in growth on nutrient dextrose agar, whereas those of feeble infectivity were of a firmer habit.

Van Der Merwe (A. J.) & Anderssen (F. G.). **Chromium and manganese toxicity. Is it important in Transvaal Citrus growing?**— *Fmg S. Afr.*, xii, 140, pp. 439–440, 2 figs., 1937.

Citrus in the western Transvaal is subject to a condition known as 'yellow branch', characterized by the yellowing either of the veins or interveinal areas (in which case mottle leaf is closely simulated) of the foliage on one or two branches of a tree. In all cases this chlorosis of the leaves is followed by the dying-back of the tips of the branches, and sometimes of the roots, while the bark becomes loose and scaly. The fruits of diseased trees are small, frequently misshapen and seedless, greenish on one side, of inferior quality, and entirely worthless commercially. 'Greening' is the name applied to a disorder of citrus with very similar symptoms prevalent in the eastern Transvaal. Analogous conditions, suspected to be due to the same cause as yellow branch, have been observed in avocado, gardenia, and tobacco. The soil in which the citrus orchards affected with yellow branch are situated was found to contain 10 per cent. chromium, largely in the form of very insoluble chromite, occurring as an admixture in a black magnetite iron deposit, and an analysis of the leaves and fruits revealed up to 10 p.p. million of chromium, calculated on a dry-weight basis. The kraal manure extensively used in the orchards was also found to contain 1·363 p.p. million chromium. In the eastern Transvaal the black ore deposits in the irrigation furrows of the orchards contained a high proportion of manganese but very little chromium, and analyses of orange leaves revealed exceptionally large amounts of the former mineral. Further work is necessary, however, before yellow branch can be definitely attributed to chromium toxicity and greening to manganese toxicity.

Henk (H. J.). **Die Zerstörung von Kunstseiden durch Bakterien und Pilze.** [The destruction of artificial silks by bacteria and fungi.]— *Kunstseide*, xix, 10, pp. 326–327, 1937.

The resistance of artificial silks to bacterial and fungal attack depends on their degree of polymerization. All the artificial silks undergo much more rapid hydrolysis than native cellulose, and may in fact be completely transformed into glucose, of which the maximum yield from native cellulose is 30 per cent. The hydrolytic splitting of native cellulose can be initiated only by cellulase, whereas cellobiase (which occurs in numerous fungi, such as *Aspergillus* and *Mucor*), lichenases, and other hemicellulases may participate in the disintegration of artificial silk.

Massey (R. E.). **Seed disinfection, with special reference to Cotton.**— *Emp. Cott. Gr. Rev.*, xiv, 4, pp. 301–307, 1937.

In this brief review of the results obtained in several years' experiments in the Anglo-Egyptian Sudan on the disinfection of cotton seed against *Bacterium malvacearum*, the author points out that a desirable seed disinfectant must possess high adherence and such toxicity and solubility that the seed is surrounded at the critical moment of attack and even under irrigation conditions by a lethal film. In tests with numerous mercurial compounds the greatest toxicity was displayed by a solution of mercuric chloride and mercuric iodide previously mixed

in a ratio of 3 to 1, which inhibited the growth of the organism when used at a dilution of 1 in 2,000,000. The paper concludes with a series of tables showing the percentage of infection obtained with seed treated with numerous dusts and that obtained with untreated seed.

Kononenko (E. V.). Лизис возбудителя вилта Хлопчатника **Verticillium dahliae,** вызываемый некоторыми миксобактериями. [Lysis of the causal organism of Cotton wilt, *Verticillium dahliae*, induced by certain myxobacteria.]—*Микробиол.* [*Microbiol.*], vi, 6, pp. 699–716, 3 pl., 1 graph, 1937. [English summary.]

Most of the soils examined in Armenia (U.S.S.R.) were found to contain myxobacteria (*Polyangium* and *Myxococcus* spp.) antagonistic to the agent of cotton wilt (*Verticillium dahliae*) [*R.A.M.*, xvii, p. 109], lysis of the mycelium of which was induced by contact with either small clots of infested soil or pure cultures of the organisms in question. This antagonistic relationship finds expression under natural conditions as well as in the laboratory, the bacteria being capable of hindering sclerotial development and destroying the young mycelium in the soil.

Petch (T.). **Notes on entomogenous fungi.**—*Trans. Brit. mycol. Soc.*, xxi, 1–2, pp. 34–67, 1937.

In this further contribution to his studies on entomogenous fungi [*R.A.M.*, xiv, p. 443] the author gives notes on 34 species, among which the following are described (with Latin diagnoses) as new to science: *Entomophthora pyralidarum* on Pyralid moths attached to the trunks of various trees in Ceylon; *Hypocrella cornea* on an Aleyrodid on *Rubus* in the Kwangsi Province, China; *Cordyceps subsessilis* on larvae of Coleoptera in wood in North America; *C. erotyli*, with its conidial stage *Spicaria* (*Isaria*) *erotyli* n.sp., on *Erotylus* sp. (Coleoptera) in Trinidad; *C. ramosa* on Coleopterous larvae in Trinidad; *C. variabilis* on larvae of Coleoptera in North America; *C. cylindrica* on a trap-door spider in Trinidad; *C. elongata* on pupae and larvae of *Apatela americana* (Lepidoptera) in North America; *Hirsutella gigantea* on pupae of the same insect also in North America; *Calonectria hirsutellae* on a leafhopper in North Carolina; *Torrubiella paxillata* on the larva of a Chrysopid (Neuroptera), in North America; *Hirsutella dipterigena* (parasitized by *Stibella kervillei*) on the fly *Blepharoptera serrata* in Derbyshire; *Hymenostilbe ampullifera* on a Tipulid (*Dicranomyia pubipennis*); *H. fragilis* on Orthoptera in Trinidad, British Guiana, and Brazil; *Spicaria* (*I.*) *laxa* on Coleopterous larvae in North America; and *Aegerita insectorum* on the larvae of *Urophora solstitialis* (Diptera) at Cambridge, England. The fungus on spiders, which was referred in 1931 by Sartory, Sartory, and Meyer to the genus *Verticillium* [ibid., x, p. 663] is believed to be most probably the same as that described in 1892 by Cavara under the name *Sporotrichum aranearum*; in the author's opinion it is a species of *Acremonium*, for which the name *A. tenuipes* nom.nov. is suggested. The name *Empusa planchoniana* [Cornu] Thaxter is stated to be based on a mis-identification. Cornu's fungus is renamed *E. planchoniana* (Cornu) Petch, and Thaxter's fungus is named *E. thaxteriana* Petch nom.nov. [but see International Rules: ibid., xvi, p. 482].

Takasu (R.). **Studien über die roten, pathogenen Hefen.** [Studies on the red pathogenic yeasts.]—*Jap. J. Derm. Urol.*, xlii, 4 (*Suppl.*), pp. 258–261, 1937.

An account is given of studies on ten red pathogenic yeasts, nine of which were obtained from Prof. Ota's collection while the tenth was isolated by the writer from a case of cystitis blastomycetica.

The results of animal inoculation experiments confirmed the pathogenicity of the following species only: *Torulopsis pararosea* (*Cryptococcus pararoseus*) Cast. [*R.A.M.*, xvi, p. 609], *T.* (*C.*) Cast. Re [? *C. castellanii*: ibid., v, p. 98], and *Candida* (*Myceloblastanon*) sp. (*Torula* II Urb. & Zach). The two organisms isolated by Yamamoto from cases of onychia (*Torulopsis* and *C.* (*M.*) spp.), though only mildly pathogenic to animals, may probably also be regarded as agents of the condition under observation.

A species of *T.* isolated by Ota and Masuda from a case of cystitis in 1930 forms cells measuring 5 to 7 by 3 to 5 μ, the corresponding dimensions for *T. pararosea*, *T.* Cast. Re, *T.* sp. (Honda B, the writer's above-mentioned isolation), and *T.* Urb. & Zach being, respectively, 2 to 5 or up to 10 μ in length, 2 to 3 μ in diameter, 3 to 5 μ in diameter, and 5 to 10 (occasionally 15 to 20) μ in length. None of these species formed a pseudomycelium.

In the case of Yamamoto's *Candida* the spherical cells measure 3 μ in diameter and the oval 5 to 7 by 2 to 5 μ, with occasional very long individuals (more than 20 μ). Rudimentary pseudomycelia are formed on carrot agar. This strain corresponds to Ota's *Mycelorhizodes*, a subgenus of *Myceloblastanon*. In *C.* (*M.*) Urb. & Zach the cells ordinarily measure 3 to 5 μ in diameter but may attain a length of 20 or 30 μ. This species, like the foregoing, produces conspicuous dendritic growth in type cultures but no pseudomycelium. These two species constitute transitional stages between *Torulopsis* and *Candida* and should provisionally be placed in the latter genus.

All the species investigated formed acid and gas from glucose, galactose, and maltose, and other sugars (except saccharose) were also more or less extensively utilized.

Wood (Martha A.) & Wellensiek (Ellen K.). **A species of fungus as an apparent pathogen in subacute or chronic inflammations of different organs of the body.**—*Tex. St. J. Med.*, xxxiii, 3, pp. 247–252, 4 figs., 1937.

Full clinical particulars are given of seven cases of subacute or chronic inflammations of various organs associated with the presence of large, spherical, yeast-like, thick-walled bodies, of the *Blastomyces* [*Blastomycoides*] type [*R.A.M.*, xv, p. 504], and small, refractile, spherical, motile bodies, frequently occurring in clusters. Inoculation experiments on rabbits gave positive results.

Halty (M.) & Charlone (R.). **Un caso de esporotricosis. Consideraciones clinicas e histológicas.** [A case of sporotrichosis. Clinical and histological considerations.]—*Arch. urug. Med.*, x, 4, pp. 459–468, 4 figs., 1937.

Particulars are given of the condition brought about by the multiple

nodular abscesses developing as a sequel to an injury on the left hand of a 40-year-old man, the pus from which yielded a fungus identified by J. E. MacKinnon as *Sporotrichum beurmanni* [*R.A.M.*, xvii, p. 39].

Mienicki (M.) & Ryll-Nardzewski (C.). **Ein Fall von Sporotrichose der Haut und der Mundschleimhaut.** [A case of sporotrichosis of the skin and of the oral mucous membrane.]—*Przegl. derm.*, xxxii, pp. 62–69, 1937. [Polish, with French summary. Abs. in *Zbl. Haut- u. GeschlKr.*, lviii, 1, pp. 68–69, 1938.]

Sporotrichum (?) *beurmanni* [see preceding abstract] was isolated on Sabouraud's agar from nodules on the right cheek and from the mucous membrane of the mouth of a young soldier and inoculated into rats with positive results. Sporotrichosis is stated to be of very rare occurrence in Poland. In the present case a decayed tooth is believed to have been the source of infection.

Arakawa (T.). **Über die sogenannte 'Schizosaccharomycosis Benedek'.** [On the so-called 'Schizosaccharomycosis Benedek'.]—*Hihu-to-Hitunyo, Hukuoka*, v, pp. 36–42, 1937. [Japanese, with German summary on pp. 3–4. Abs. in *Zbl. Haut- u. GeschlKr.*, lvi, 6, p. 410, 1937.]

Schizosaccharomyces hominis [= *Mycoderma hominis* (Ben.) Vuillemin: *R.A.M.*, ix, p. 244] was isolated in pure culture from two cases presenting extensive erythemato-squamous or -papulous foci. The organism was pathogenic to mice and rabbits. The systematic position of *S. hominis*—as yeast or bacterium—is left open [but an editorial note states that Benedek, in a recent personal communication, has referred it to the sporogenous bacteria].

Rivelloni (G.). **Isolamento di un raro micete (Malbranchea bolognesii-chiurcoi) da una micosi umana.** [The isolation of a rare fungus (*Malbranchea bolognesii-chiurcoi*) from a human mycosis.]—*Boll. Sez. reg. (Suppl. G. ital. Derm. Sif.)*, xvi, 3, p. 384, 1937.

Malbranchea bolognesii-chiurcoi [*R.A.M.*, vi, p. 483] was isolated on Sabouraud's agar from an erythematous-pustular lesion on the upper lip of a young man in Italy.

Franchi (F.). **Lesioni cutanee da Cephalosporium acremonium Corda. (Contributo clinico-sperimentale.)** [Cutaneous lesions due to *Cephalosporium acremonium*. (A clinico-experimental contribution.)]—*Dermosifilografo*, xii, pp. 301–326, 1937. [Abs. in *Zbl. Haut- u. GeschlKr.*, lviii, 1, p. 69, 1938.]

Cephalosporium acremonium [*R.A.M.*, xv, p. 580] was isolated at Turin from a 42-year-old peasant woman who had been suffering for three years from scattered chronic, gummatous skin nodules following injury to the leg. The fungus was inoculated into guinea-pigs and white rats which developed swellings similar to those observed in the human patient.

Gougerot (H.). **Pityriasis versicolor invisibles révélés par la leucomélanodermie solaire ponctuée.** [Invisible foci of pityriasis versicolor revealed by punctuated solar leucomelanodermia.]—*Arch. derm.-syph., Paris*, ix, 2, pp. 231–238, 1 fig., 1937.

Details are given of the symptoms and treatment of six cases in which pityriasis versicolor, associated with profuse infection by *Malassezia furfur* [*R.A.M.*, xvii, p. 38], developed as a sequel to sun-bathing.

Durham (O. C.). **Incidence of air-borne fungus spores. I. Alternaria.**—*J. Allergy*, viii, 5, pp. 480–490, 1 fig., 4 graphs, 1 map, 1937.

From the results of the exposure of some 2,000 vaseline-coated slides in 40 localities of the United States in 1936, supplemented by data from about 3,000 of the writer's slides exposed during 1933, 1934, and 1935, it was found that the average number of *Alternaria* spores per cu. yd. of air for a 24-hour period is considerably more than 25. Considering the size of the *A.* spore particles and their quantitative distribution, they may be assumed to be inhaled in amounts comparable to the pollen of ragweed [*Artemisia*] and to be similarly implicated in the etiology of asthma and hay-fever [*R.A.M.*, xvi, p. 533 and next abstract].

Prince (H. E.) & Morrow (Marie B.). **Molds in the etiology of asthma and hay fever with special reference to the coastal areas of Texas.**—*J. sth. med. Ass.*, xxx, 7, pp. 754–762, 2 figs., 3 graphs, 1 map, 1937.

Moulds, including *Monilia sitophila*, *M. geophila*, *Aspergillus niger* (group), *A. sydowi*, *A. japonicus*, and species of *Penicillium*, *Trichoderma*, *Hormodendrum*, *Helminthosporium*, and *Cladosporium*, are stated to be excessively prevalent (the number of spores per cu. yd. of air being estimated at 2,688 in 24 hours) in certain coastal regions of Texas, to which they are conveyed by north winds from the swampy interior. Encouraging results have been obtained by therapeutic injections with extracts of these organisms, and also of *Alternaria*, not recovered locally, into patients suffering from respiratory allergic disorders of the asthma and hay-fever type [cf. preceding abstract].

Davidson (A. M.) & Gregory (P. H.). **The spiral hyphae of Trichophyton.**—*Trans. Brit. mycol. Soc.*, xxi, 1–2, pp. 98–113, 15 figs., 1937.

As a result of their studies in Winnipeg, Manitoba, the authors are led to believe that the spiral hyphae [*R.A.M.*, xiii, p. 578] which develop in pure cultures of species of *Trichophyton*, and for the most part are not considered to possess any particular function, are in reality organs of attachment and play a part in the dissemination of the fungus. Observations on the development of these hyphae in cultures of *T. gypseum*, *T. interdigitale*, *T. asteroides*, *T. granulosum*, and *T. persicolor* showed that all the spirals were counter-clockwise; occasional clockwise spirals were, however, found in some isolates of *T. interdigitale*. When mature, the spirals are empty, dead hyphae, flattened in a plane at right angles to the axis of the spiral, and may

be branched. After deformation by mechanical contact the spirals regain their original shape, a process which is probably aided by the flattening of the hyphae. Further observations indicated that the mycelium of *T. gypseum* is sticky, and tends to adhere to objects coming into contact with it, a property which is not shared by *Microsporon felineum*. In the authors' opinion, the function of the spirals is to present a large adhesive surface, and thus to ensure that a relatively large inoculum becomes attached to an animal coming into contact with the saprophytic mycelium.

In an appendix to this paper a method is briefly described for determining the spiral structure of microscopic objects by differential focussing.

Kammer (A. G.) & Callahan (R. H.). **Torch oil dermatitis: its relation to epidermomycosis ('ringworm').**—*J. Amer. med. Ass.*, cix, 19, pp. 1511–1517, 2 figs., 1937.

Torch oil dermatitis, an eruption of the hands of machinists in steel mills, appears from a study of 30 cases to be correlated with the existence of a focus of interdigital epidermomycosis [*Trichophyton interdigitale*: *R.A.M.*, xvii, p. 176] of the feet.

Milovanovich (M.). **Favus bei einem Neugeborenen.** [Favus in a newborn infant.]—*Med. Rev., Belgrade*, xii, p. 65, 1937. [Serbo-Croatian, with French summary. Abs. in *Zbl. Bakt.*, Abt. 1 (Ref.), cxxvii, 23–24, pp. 526–527, 1937.]

The infant of a mother affected for 20 years by favus developed facial symptoms of the disorder four days after birth. In both mother and child the clinical features and microscopic observations pointed to *Trichophyton faviforme album* [*T. album*: *R.A.M.*, xvi, pp. 316, 810], the sole known agent of the disease in Yugoslavia, and this fungus was subsequently isolated in pure culture. Guinea-pigs inoculated with cultures from the mother developed favus in a week and *T. album* was recovered from the lesions.

Milovanovich (M.). **Doppelte Infektion mit Dermatophyten.** [Double infection with dermatophytes.]—*Med. Rev., Belgrade*, xii, pp. 15–16, 1937. [Serbo-Croatian, with French summary. Abs. in *Zbl. Haut- u. GeschlKr.*, lviii, 2, pp. 130, 1938.]

An account is given of four cases in which the same patient was infected by two distinct dermatophytes—*Trichophyton album* [see preceding abstract] and *T. violaceum*, the latter also occurring in the company of *Microsporon audouini*. These three fungi are stated to be the most common agents of human and animal dermatomycoses in Yugoslavia, where their development is favoured by the prevailing low standards of hygiene.

Kozlova (Mme R. F.) & Lavrentieva (Mme L. I.). **Erreger der Pilzerkrankungen in Kirgisien.** [The agents of fungal diseases in Kirghizia.]—*Vyestn. venerol. derm.*, iii, pp. 289–294, 1937. [Russian. Abs. in *Zbl. Haut- u. GeschlKr.*, lvii, 5–6, p. 465, 1937.]

Men are stated to be much more liable than women to favus in

Kirghizia (U.S.S.R.), whereas trichophytosis affects both sexes indiscriminately. *Achorion schoenleini* was isolated in 40·9 per cent. of the cases examined and *Trichophyton violaceum* [*R.A.M.*, xiii, pp. 96, 511, and preceding abstract] in 43·1.

Minami (S.) & Higuti (K.). **Ein Fall von tinea imbricata.** [A case of tinea imbricata.]—*Hihu-to-Hitunyo, Hukuoka*, v, pp. 431–437, 9 figs., 1937. [Japanese. Abs. in *Zbl. Haut- u. GeschlKr.*, lviii, 1, p. 68, 1938.]

Endodermophyton tropicale or *E. indicum* [*Trichophyton indicum*], collectively known as *E.* [*T.*] *concentricum* [*R.A.M.*, xvi, p. 457], was isolated at Hukuoka from the infected sites in a Philippine woman suffering from tinea imbricata and inoculated into a human patient with positive results in the form of mycelium in the squamae, as in the original instance. In Japan the disease is not prevalent, having been reported only from Formosa, Manchukuo, and the tropical islands.

Muende (I.) & Webb (P.). **Ringworm fungus growing as a saprophyte under natural conditions.**—*Arch. Derm. Syph., Chicago*, xxxvi, 5, pp. 987–990, 2 figs., 1937.

In April, 1936, the writers visited a farm near Oxford, England, to investigate a severe outbreak of ringworm among calves kept in stone-walled sheds with wooden partitions and feeding-troughs. Cultures obtained from the hair and scales of the animals was identified as *T. gypseum asteroides* [*T. mentagrophytes*: *R.A.M.*, xvii, pp. 38]. Three months later a comprehensive collection of fungi was made in the same sheds, and one of the 47 specimens collected was identical with that obtained from the calves. Experimental inoculations showed it to be pathogenic to guinea-pigs. Fourteen healthy calves confined in the sheds during the following October also contracted the disease. This is believed to be the first record of a ringworm fungus growing as a saprophyte in nature.

Sanborn (J. R.). **Microbiological control in the manufacture of paper wraps and containers for foods.**—*Industr. Engng Chem.*, xxix, 8, pp. 949–951, 3 graphs, 1937.

Among the micro-organisms liable to occur as contaminants in mills engaged in the manufacture of paper and board for food wrappers and containers may be mentioned *Oidium* [*Oospora*] *lactis* [*R.A.M.*, xvi, p. 198], *O.* [*Pullularia*] *pullulans*, *Aspergillus fumigatus*, *Monilia candida* [*Candida vulgaris*], *Trichoderma lignorum*, *Mucor racemosus*, *Botrytis cinerea*, *Cladosporium herbarum*, and *Penicillium guttulosum*. Control should be based on chlorination of the process water, supplemented if necessary by dripping in copper sulphate solution at focal points in the system, and on the immediate encasing and sealing of wrapper and container stock to avoid exposure to infection. Direct human contact should be reduced to a minimum, and in fact, detailed studies of the micro-organisms present in paper containers for milk indicate the necessity for adopting hygienic procedures at every step in their fabrication in order to reach the requisite grade of cleanliness.

Cook (W. R. I.) & Collins (W. B.). **A Pythium wilt of Primula caused by Pythium spinosum Sawada.**—*Trans. Brit. mycol. Soc.*, xxi, 1–2, pp. 29–33, 7 figs., 1937.

A serious outbreak of wilt of *Primula sinensis* seedlings in the seed pans occurred at the John Innes Horticultural Institution in 1934, and was found to be associated with the presence of *Pythium spinosum* [cf. *R.A.M.*, xi, p. 330], which was isolated consistently from infected material. The soil used, however, had been sterilized for 40 min. at 100° C. and then had been left exposed in a soil bin for six weeks before it was used for potting the seedlings. [No infection experiments with the fungus are described.]

Moore (W. C.) & Buddin (W.). **A new disease of Tulip caused by species of Pythium.**—*Ann. appl. Biol.*, xxiv, 4, pp. 752–761, 1 pl., 1937.

An account is given of the authors' studies of a disease of tulips, isolated outbreaks of which have been reported since the end of 1934 from Lincolnshire, Northamptonshire, Yorkshire, and Middlesex, and which is mainly characterized by a root rot, and dwarfing and lack of vigour in the plants, sometimes accompanied, however, by a partial or complete destruction of the bulbs and bases of the flowering shoots. Isolations from diseased material yielded a species of *Pythium*, which was shown in pure culture to be nearly related to, though not identical with, *P. de Baryanum* var. *pelargonii* [*R.A.M.*, xvi, p. 814]. A culture isolated from diseased tulip bulbs in Holland and another one from tulips affected with zonal rot in Denmark [ibid., xiv, p. 559] were both identified as *P. ultimum*. Inoculation experiments with William Copland tulips indicated that under special conditions of soil or environment, not yet clearly understood but probably involving a relatively high temperature and a moisture factor, both the English and the continental organisms are capable of attacking tulip bulbs, and that the disease may be contracted from the soil or carried with the bulbs. It is believed that the trouble may be easily controlled by examining the tulip bulbs as soon as they are received, and by discarding all the rotting ones; the rest should be stored in trays in a dry and not too warm atmosphere; forcing should be done in suitable, previously sterilized soil.

Blumer (S.). **Untersuchungen über die Biologie von Ustilago violacea (Pers.) Fuck. I. Mitteilung: Ernährungs- und Kulturbedingungen. Wirkungen des Saponins.** [Studies on the biology of *Ustilago violacea* (Pers.) Fuck. Note I: Nutritional and cultural requirements. Effects of saponin.]—*Arch. Mikrobiol.*, viii, 4, pp. 458–478, 6 graphs, 1937.

Full particulars are given of the writer's cultural experiments at the Botanical Institute of Berne University with *Ustilago violacea* [*R.A.M.*, xvi, pp. 180, 726] f. *melandrii-rubri*, a few supplementary tests also being carried out with ff. *silenes-nutantis* and *dianthi-deltoidis*, all procured from the Bureau voor Schimmelcultures, Baarn.

The medium used consisted of 0·15 per cent. each of asparagin and potassium dihydrogen phosphate, 0·05 per cent. magnesium sulphate,

and a carbohydrate. No carbohydrate induced satisfactory growth without the addition of saponin (commercial brands) at concentrations up to 5 per cent., in the presence of which, however, arabinose, sorbite, mannite, levulose, glucose, mannose, saccharose, maltose, and salicin served as valuable sources of carbon. The stimulatory effect of saponin was found to be due to the admixture of an accessory substance (identified after the paper was sent to press as the growth hormone aneurin) [ibid., xvii, p. 196].

SCHOPFER (W. H.). **Über die Einwirkung von Aneurin auf das Wachstum von Ustilago violacea.** [On the influence of aneurin on the growth of *Ustilago violacea*.]—*Ber. dtsch. bot. Ges.*, lv, 9, pp. 572–576, 1 graph, 1937.

Following up Blumer's studies on the beneficial influence of aneurin (the vital principle of saponin) on the development of cultures of *Ustilago violacea* on a synthetic medium [see preceding abstract], the writer ascertained the optimum dose of the growth hormone for this purpose to be 0·006 γ per 25 c.c. of nutrient solution. As in the case of *Phycomyces* and *Staphylococcus*, the aneurin molecule as a whole may be replaced by a mixture of its two components, 2-methyl-4-amino-5-amino-methyl-pyrimidin and 4-methyl-5(β-oxyethyl)-thiazol, without loss of growth-promoting efficacy.

STORCK (A.). **Die wirtschaftliche Bedeutung der Sommeraster (Callistephus chinensis Nees) für den deutschen Gartenbau und die Ueberwindung der Anbaukrise durch die Züchtung welkeresistenter Rassen.** [The economic importance of the China Aster (*Callistephus chinensis* Nees) in German horticulture and the breeding of wilt-resistant strains as a means of overcoming the crisis in its cultivation.]—*Landw. Jb.*, lxxxv, 1, pp. 83–163, 16 figs., 2 diags., 6 graphs, 1937.

This is an exhaustive, fully tabulated, and copiously documented account of China aster (*Callistephus chinensis*) cultivation in Germany, with special reference to the economic importance of this favourite annual, and to the possibilities of breeding for resistance as a means of combating the wilt disease (caused chiefly by *Fusarium oxysporum* f. 6 [*R.A.M.*, xiv, p. 447], occasionally associated with *F. conglutinans* var. *callistephi* [ibid., xvi, pp. 753, 812]), which seriously threatens the commercial production of the crop.

C. chinensis is cultivated both for seed and market purposes, the plantings for the former object (mainly located in Saxony and Thuringia) covering about 100 hect. with an estimated yield value of Rm. 180,000 to 250,000, while those for the latter extend over some 1,500 to 1,650 hect. The crop being largely grown by smallholders without adequate facilities for the execution of the soil disinfection operations essential to the control of the pathogens, the systematic development of wilt-resistant varieties assumes considerable urgency. In experiments carried out from 1934 to 1936 the inherently powerful resistance of the American strains (some 130 of which were tested) was found in most cases to undergo appreciable diminution as a result of continuous cultivation in Germany: this is attributed to the practice,

which should immediately be rectified, of raising seed crops on fresh sites instead of on old, infested soil where the accumulated virulence of the pathogens calls forth the natural resistance of the plants. Among the commercial varieties wilt-resistant strains were found only in three classes, viz., very tall, represented by American Bush and Beauty, tall (Giant Comet and Ostrich Feather), and medium (Halls), leaving an immensely wide scope for further breeding activity. It was further shown by these experiments that *F. oxysporum* f. 6 is of negligible importance in German seed-beds, while appreciable damage by *Verticillium albo-atrum* [ibid., xiv, p. 447] is of rare occurrence.

Wenzl (H.). **Botrytis cinerea als Erreger einer Fleckenkrankheit der Knospen und Blüten der Rose (' Blütenfeuer ').** [*Botrytis cinerea* as the agent of a spot disease of Rose buds and petals ('petal fire').]—*Gartenbauwiss.*, xi, 4, pp. 462–472, 3 figs., 1938.

Following very changeable weather during the latter half of July and exceptionally heavy rainfall on the first few days of August, 1936, a severe epidemic of *Botrytis cinerea* broke out in an extensive Lower Austrian rose nursery [*R.A.M.*, xiv, pp. 313, 363], where the plants not only suffered from the familiar brown rot of the buds, flowers, bud stalks, and leaves, but also showed a necrotic spotting of the petals, dark red and zonate on white, pink, or orange varieties, colourless and water-soaked on dark red ones, while on pure yellow the red margin was not invariably present. The lesions, mostly 2 to 3 or up to 5 mm. in diameter, were frequently so densely aggregated as to coalesce in the later stages. Infection usually took place on the closed buds but sometimes on the fully open flower; on one variety (Mrs. Pierre de Pont) the petals were occasionally irregularly crinkled.

Inoculation experiments on cut roses in the greenhouse resulted in the same symptoms as were observed in the open. None of the 140 varieties inspected proved to be entirely resistant to the fungus, though not all manifested the unusual floral spotting herein described. Only mild symptoms, however, were exhibited by Nigrette, Rev. F. Page Roberts, Roslyn, Talisman, and Ville de Paris.

Wijers (Everdina E.). **Phytophthora wilt in Carnation plants.**—*S. Afr. J. Sci.*, xxxiv, pp. 194–213, 3 figs., 1937.

This is an account of a serious wilt of carnations, which is stated to have been prevalent in Pretoria since 1935, and specimens of which were also received from nurseries in four other localities in South Africa. The condition is characterized by a rapid and complete wilting of the plants within 24 to 48 hours, a light greenish-grey discoloration of the leaves, and a rot of the lateral roots. The tissues of the crown and stem base have a brown, water-soaked appearance. Isolations from diseased tissues [by a technique which is briefly described] yielded pure cultures of a species of *Phytophthora*, four strains of which, originating from carnation plants of different ages, were compared with two strains isolated from wilted sweet sultan (*Centaurea*) and *Verbena* plants, respectively, and with *P. cactorum* from snapdragon (*Antirrhinum majus*) [*R.A.M.*, xiv, p. 238]; although these seven strains showed considerable variation, even within themselves, in the size and pro-

duction of sporangia, the production of oogonia, and in their growth and temperature relations, the author considers that all belong to the *P. cactorum* group; all were shown in inoculation experiments to be capable of attacking carnations, and all also caused rotting of tomatoes, potatoes, apples (one strain being very weakly pathogenic), and grapefruits. Mycelium of a species of *Fusarium* was also found in wilted carnations [ibid., xvii, p. 182], but soil inoculations with seven species of the same genus, obtained from the Centralbureau voor Schimmelcultures, Baarn, all described in relation to carnation wilt, gave negative results after six months. A species of *Rhizoctonia*, which was occasionally isolated from wilted carnations, when inoculated into the soil was shown to be capable of causing stem rot in this host.

Cannon (O. S.). **A Botrytis disease of the Dahlia and its relation to Botrytis diseases of other plants.**—*Proc. Utah Acad. Sci.*, xiv, pp. 41–43, 1937.

Dahlia roots attacked by a *Botrytis* of the *cinerea* type [*R.A.M.*, xv, p. 370] were received at the Utah State College and inoculation experiments with the fungus showed it to be capable of attacking all parts of the dahlia. The fungus is closely related to forms of *Botrytis* causing diseases of other plants. Control measures recommended are field sanitation, proper spacing of the plants, and storage in a cool, fairly dry atmosphere.

Osborn (H. T.). **Vein-mosaic virus of Red Clover.**—*Phytopathology*, xxvii, 11, pp. 1051–1058, 3 figs., 1937.

Vein mosaic virus of red clover (*Trifolium pratense*) was originally obtained from naturally infected plants in New Jersey, which were found by repeated passage to seedlings by means of the pea aphid [*Macrosiphum pisi*] to be infected with more than one virus. Some plants showed the mottling associated with pea virus 2 [*R.A.M.*, xvi, p. 722], while others exhibited a yellow coloration along the veins, sometimes accompanied by small, yellow spots in the interveinal areas. Successive passages to healthy clover plants resulted in the isolation of a virus that produced only vein mosaic symptoms.

The following plants were infected by the red clover vein mosaic virus, using *M. pisi* as a vector: broad bean (*Vicia faba*), Olympia sweet pea, red clover, white clover (*T. repens*), alsike (*T. hybridum*), and crimson clover (*T. incarnatum*). The virus was also transmitted mechanically (by leaf-rubbing) from red clover to *V. faba* and from *V. faba* to red, white, alsike, and crimson clovers, white sweet clover (*Melilotus alba*), Canada white field pea, and Alderman, Telephone, Perfection, and Horal garden peas. The usual incubation periods of the disease in red clover, *V. faba*, and peas are three to four weeks (but may be 14 days or as long as six weeks), 14 to 21 days, and 12 to 14 days, respectively. In *V. faba* infection assumes the forms of local necrotic splotches and rings, vein-clearing, tissue distortion on the under leaf surfaces giving the appearance of whitish bands along the veins, a purplish discoloration of the stalk surfaces, severe stunting, and clump production at the stem bases. Peas also show vein-clearing, rosetting of the apical leaves, and rapid wilting, the plants frequently

being dead three weeks after inoculation. The few sweet peas infected showed comparable symptoms.

The specific vein mosaic virus was found to be active (as determined by mechanical inoculations on *V. faba*) after ten minutes' heating at 58° C., but not after the same period at 60°, and it resisted two but not three days' ageing.

No incubation period of the virus was observed in colonies of *M. pisi* fed on diseased plants and then transferred to a succession of healthy ones for a total period of 14 days. The pea aphid was found to acquire and transmit the virus within a period of two hours, and to lose it during a single day's feeding on healthy plants.

Cormack (M. W.). **Fusarium spp. as root parasites of Alfalfa and Sweet Clover in Alberta.**—*Canad. J. Res.*, Sect. C, xv, 11, pp. 493–510, 1 pl., 1 fig., 1 graph, 1937.

This is a study of five predominant species of *Fusarium*, viz., *F. avenaceum*, *F. arthrosporioides*, *F. culmorum*, *F. poae*, and *F. scirpi* var. *acuminatum*, which cause the root rots of lucerne (*Medicago falcata*, *M. sativa*, and *M. media*) and sweet clover (*Melilotus alba* and *M. officinalis*) in Alberta. The two first-mentioned species appear to be the most important since they occur commonly and cause serious injury to the roots both in the early spring and during the growing season. *F. culmorum* attacks the roots only during the summer, when it causes rapid death of the plants. *F. poae* and *F. scirpi* var. *acuminatum* are comparatively weak pathogens. *F. arthrosporioides*, *F. culmorum*, and *F. poae* are new records on both hosts, as is *F. scirpi* var. *acuminatum* on sweet clover.

The amount of infection with the *F.* spp. was found to be correlated with the soil temperature, especially in the case of *F. culmorum*, two isolates of which were highly pathogenic in July, when the soil temperature averaged 20° C., but caused only slight infection in September, when the soil temperature averaged 12°. Both *F. avenaceum* and *F. arthrosporioides* caused approximately the same degree of injury in September as in July. Both species grew well in pure culture at a wide range of temperature, with a minimum of −2°, an optimum at about 24°, and a maximum at 34°, whereas *F. culmorum* required a higher temperature and showed a minimum of 3°, an optimum at 24° to 27°, and a maximum at 34° to 36°, making only very slow growth at temperatures below 10°. The cardinal temperatures for *F. poae* and *F. scirpi* var. *acuminatum* were −2°, 20° to 24°, and 32°, and 1°, 24°, and 34°, respectively. All five species grew well at hydrogen-ion concentrations ranging from P_H 4·0 to 9·5, particularly in the alkaline range. Carbon dioxide concentrations up to 20 per cent. did not appreciably influence the growth of *F. avenaceum*, *F. arthrosporioides*, or *F. poae*, but concentrations of 15 to 20 per cent. had a retarding effect on *F. culmorum* and *F. scirpi* var. *acuminatum*, which was greater at a temperature of 8° than at room temperature.

F. avenaceum easily penetrated the roots through the basal tissue of branch roots and through lenticels, and readily invaded the central portions of the tap-root, causing a rapid rotting. The hyphae proceeded singly or aggregated into strand-like masses which forced their way

through the tissues, the fungus apparently exerting a toxic action some distance beyond the infected area.

In field infection experiments isolates of *F. avenaceum* obtained from oats and barley caused moderate and light infection, respectively, on roots of sweet clover, but were only slightly pathogenic to lucerne. An isolate from wheat was non-pathogenic. Isolates of *F. culmorum* from wheat were almost as virulent as one from sweet clover. On the other hand, in greenhouse tests strains of *F. avenaceum*, *F. culmorum*, and *F. arthrosporioides* isolated from lucerne or sweet clover caused heavy infection of wheat and light to heavy infection of barley and oats. Another experiment showed that three variants of *F. avenaceum* were decidedly less virulent than the original isolation from sweet clover.

Sampson (Kathleen). **Further observations on the systemic infection of Lolium.**—*Trans. Brit. mycol. Soc.*, xxi, 1–2, pp. 84–97, 2 pl., 20 figs., 1937.

Continuing her studies on the endophytic fungus of *Lolium* spp. [*R.A.M.*, xiv, p. 700; xvi, p. 616], the author states that in 1929 a second endophytic fungus was found to be present in a parent (No. 1972) selected in that year from a pedigree culture of *L. perenne*, which was first noticed by the fact that its mycelium in scrapings from the pith of the host was very faintly stained with cotton blue (owing to the presence of large vacuoles and sparse cytoplasm), in contrast to the richly coloured mycelium in a stained mount of the first endophyte. Experiments from 1930 to 1935, inclusive, showed that, like the first, the second endophyte is transmitted by vegetative propagation of the host, and also by the seed, the chief points of difference between the two, apart from mycelial characteristics, being that the second does not form a thick zone of mycelium in the fruit, and that it grows readily on all kinds of media, whereas cultures believed to represent the first endophyte could only be obtained on coagulated egg disks. In pure culture the second endophyte produces a rather compact, fluffy, funiculose, aerial mycelium, white to cream in colour, the submerged mycelium often discolouring the substratum chrome-yellow. In addition, and especially on natural media such as potato, rice, and wheat grains, it produces rather numerous spirally coiled hyphae somewhat resembling those observed in certain dermatophytes [see above, p. 243], and abundant hyaline, oval microconidia, measuring 2 to 2·5 by 1·5 μ. Since no other types of spores and no sclerotia have been seen either in pure culture or in nature, it was not possible to determine the taxonomic position of this organism, which can only be designated for the present as the second endophytic fungus of *L. perenne*.

After isolation on coagulated egg the first endophyte grew in agar media, on which it has so far always remained sterile, thus giving no clue to its identity.

Richards (B. L.). **Susceptibility of Alfalfa varieties to bacterial stem blight.**—*Proc. Utah Acad. Sci.*, xiv, pp. 33–38, 2 graphs, 1937.

Continuing his studies on varietal resistance of lucerne to bacterial stem blight [*Bacterium medicaginis*: *R.A.M.*, xiii, p. 774], the author found that Ladak again proved the most resistant variety (0·87 per

cent. coefficient of susceptibility) in experiments carried out in 1935, followed by Cuban (1·36), Cossack 10643 (1·37), French 19272 (1·88), Grimm Utah (1·96), Grimm Lat. 496 (1·99), and Grimm Sask. 666 (2·07). The most susceptible were French 19274 (3·87), Turkestan 15754 (3·77), and South Africa 14203 (3·75). Hardigan 18999, which compared favourably with Ladak in 1933, was more susceptible (2·21) in 1935. While Ladak exhibits resistance to both stem blight and wilt [*Aplanobacter insidiosum*: ibid., xvi, p. 559], Turkestan, the most resistant variety to wilt, is the most susceptible to stem blight. Grimm varieties are highly susceptible to wilt but considerably resistant to stem blight. The severity of stem blight in both 1933 and 1935 was definitely correlated with frost injury.

PAPE (H.). **Beiträge zur Biologie und Bekämpfung des Kleekrebses (Sclerotinia trifoliorum Erikss.).** [Contributions to the biology and control of Clover stem rot (*Sclerotinia trifoliorum* Erikss.).]—*Arb. biol. Anst.* (*Reichsanst.*) *Berl.*, xxii, 2, pp. 159–247, 15 figs., 1 graph, 1937.

An exhaustive, fully tabulated account is given of the writer's studies on the biology and control of *Sclerotinia trifoliorum*, the causal organism of clover stem rot [*R.A.M.*, xvii, p. 185]. The fungus was found to develop profusely on such sugar- or starch-containing media as soaked cereal grains, bread (on which giant sclerotia were formed), and maltyl meat extract agar. Ammonium salts and asparagin promoted mycelial growth, the former also stimulating the formation of large sclerotia; urea suppressed sclerotial production, while glycocol favoured the development of numerous minute sclerotia. The optimum galactose and dextrose concentration for sclerotial production was 5 per cent. *S. trifoliorum* was found to tolerate a wide range of hydrogen-ion concentrations but grew best on the acid side of the scale (round about P_H 5·5), the minimum, optimum, and maximum temperatures for its development being 0°, 15° to 20°, and near 33° C. Exposure to an atmosphere containing up to 5 per cent. carbon dioxide seemed rather to augment than to depress the growth of the fungus.

Appreciable differences, especially in respect of growth rate and habit, between the 36 strains of *S. trifoliorum* are considered to point to the existence of physiologic races within the fungus, and this was confirmed by inoculation experiments.

The mycelium and ascospores of the stem rot organism, when kept in a dry state, remained viable for rather more than seven months; sclerotia buried in the soil mostly lived for 7½ years, but only some of those kept dry in the laboratory survived for 4½ years. Viable sclerotia of *S. trifoliorum* were found in commercial samples of red, white, and crimson clovers (*Trifolium pratense*, *T. repens*, and *T. incarnatum*), *Medicago lupulina*, lucerne, *Anthyllis vulneraria*, and white sweet clover (*Melilotus alba*). In the case of mature plants the sclerotia were found exclusively on the stems, sometimes at a height of 20 to 40 cm., a fact that explains their presence in harvested material and transmission to the seed during threshing operations. The perpetuation of *S. trifoliorum* by means of the mycelium and ascospores is regarded as dubious. The sclerotia may be readily eliminated from clover seed by dusting the

sample with iron powder, which adheres only to the sclerotia, which are then removed by means of a powerful electro-magnet. In the case of large-seeded clovers, such as *T. incarnatum* and *T. pratense*, the sample may be shaken into a 23 to 24 per cent. potassium chloride solution, in which the sclerotia and defective seeds float while the good seed sinks. None of the standard fungicides tested was destructive to the sclerotia of *S. trifoliorum* except at high concentrations and acting for lengthy periods, under which conditions the germinability of the clover seed was impaired. It was, however, possible so to weaken the sclerotia that they were unable to form apothecia by 30 minutes' immersion of red, white, or crimson clover seed in 0·1 per cent. mercuric chloride (or 15 minutes' at 0·5 per cent. for the two first-named). The ascospores of the fungus succumbed to 15 minutes' immersion in 0·25 per cent. germisan or uspulun.

According to information based on a study of the relevant literature, supplemented by five years of practical observation in the field in Schleswig-Holstein, the writer concludes that *T. pratense*, *Medicago lupulina*, *T. incarnatum*, and *A. vulneraria* are highly susceptible to stem rot, *Onobrychis sativa*, *Melilotus alba*, and lucerne moderately so, and *T. hybridum*, *Lotus corniculatus*, and *T. repens* resistant. Under local conditions foreign strains from comparatively warm regions proved to be more susceptible than home-grown clover or that imported from districts with a fairly cold climate, while early ripening strains tended to be more severely attacked than late ones.

A case of stem rot was actually observed in *Vicia sepium* and the pathogenicity of *S. trifoliorum* to winter peas is suspected. *V. sativa* was attacked by the fungus in an inoculation test, and in one case the passage of the mycelium from crimson clover to the leaves of adjacent winter rape plants was detected. The following weeds (all new hosts for *S. trifoliorum*) were found harbouring the fungus in the course of field inspections in Schleswig-Holstein: *Erodium cicutarium*, *Taraxacum officinale*, *Holosteum umbellatum*, *Scleranthus perennis*, *Melandryum album*, and *Silene nutans*. The strain of the fungus from *E. cicutarium* was pathogenic in inoculation experiments on *Trifolium pratense*, *T. hybridum*, and *Medicago lupulina*, while that from *Taraxacum officinale* attacked *Trifolium incarnatum* in addition to the foregoing.

A considerable reduction in the incidence of stem rot may be effected by mowing the clover in the autumn, followed by rolling and grazing by livestock, the last-named measure being particularly helpful. Further directions are given for combating *S. trifoliorum* along the lines indicated by these investigations.

Smith (C. O.). **Inoculation of some economic plants with Phytophthora cactorum and P. citrophthora.**—*Phytopathology*, xxvii, 11, pp. 1106–1109, 1 fig., 1937.

Among the more susceptible of some 50 economic plants whose woody stems were inoculated with the mycelium from pure cultures of *Phytophthora cactorum* and *P. citrophthora* on potato glucose agar were walnut (especially *Juglans californica*, *J. hindsii*, *J. regia*, and *J. nigra*, *P. cactorum* being the more virulent) [*R.A.M.*, xi, p. 339] and twelve Rosaceae, including cherry (*Prunus avium*), apricot, *P. mume*, peach,

pear, and apple. Other plants contracting an appreciable degree of infection were *Cedrus deodara*, *Castanea* sp., *Ceratonia siliqua*, ash, avocado, *Eucalyptus* sp., and an evergreen elm.

Friedrich (G.). **Eine einfache Kontrolle des Fusicladium Sporenfluges (Venturia inaequalis [Cooke] Aderhold).** [A simple method of following the spore discharge of *Fusicladium* (*Venturia inaequalis* [Cooke] Aderhold).]—*Gartenbauwiss.*, xi, 4, pp. 457–461, 2 figs., 1 graph, 1938.

The apparatus devised by the writer for following the spring discharge of the apple scab (*Venturia inaequalis*) ascospores [*R.A.M.*, xvi, p. 469] in the vicinity of Hamburg consisted of a wooden air-tight chamber fitted with five spore traps in the form of vaselined cover slips which are impinged upon in turn by the air admitted through an apical funnel. The apparatus [which is described in detail] was fixed to the branch of a tree in the middle of a large stand of Beauty of Boskoops at a height of 1·5 m. and attached by a pressure tube to a motor suction pump absorbing 15 l. air per minute. The microscopic examination of the slips at the end of an hour showed that the bulk of the ascospores adhered to the top one, from which alone, in general, spore counts need be made.

Using this contrivance in 1937, the writer found that the ascospore discharge began on 15th April and reached a climax with a heavy shower of rain on 21st, following a few warm, dry days. The next outbreak occurred on the morning of 5th May, when after a heavy thunder shower 120 spores were trapped on the first slip from 900 l. of air (one hour's suction). By the evening of the same day the spores had been largely eliminated from the atmosphere by the heavy rainfall, only 15 being trapped in an hour. A temporary rise the next day to 40 per hour was rapidly succeeded by a substantial decline, the few spores trapped during the rest of the month being just the remnants of the main discharge.

Under local conditions in the Altenland, therefore, the period during which the apple trees required fungicidal treatment against infection by scab ascospores was relatively short, and one or two applications would have sufficed for control. The practical importance of the spore-catching method herein described lies in the rapidity with which the spores are trapped during the abundant discharge foretelling an epidemic outbreak, and the consequent saving of time in the initiation of preventive spraying operations.

Davis (M. B.). **Fertilizer problems and physiological disorders in Ontario.**—*Rep. pomol. Soc. Quebec, 1936*, pp. 34–39, 1937.

A somewhat alarming increase of physiological disorders of apples has been observed in Ontario during recent years, sometimes caused by wrong fertilizer practice or by soil difficulties amenable to correction. Leaf scorch [*R.A.M.*, xv, p. 587] is one of the most common foliage troubles, and occasionally may be due to waterlogged conditions of the soil leading to the destruction of the lower root system and resulting in reduction of potassium absorption, which takes place largely from the lower layers. The disease, if allowed to develop unchecked, finally

results in die-back of the affected trees. Another disorder characterized by the bronzing of the leaf, sometimes accompanied by purple coloration, is attributed to deficiency in phosphorus. The increasing prevalence of internal cork [ibid., xvi, p. 819] was studied and it was observed to develop more in dry years than in wet years. Bitter pit is prevalent in soils high in nitrogen where the trees show excessive vigour or leaf scorch symptoms are common. Inactivation of iron by high lime content of the soil and of manganese by a similar cause, or perhaps actual manganese deficiency, have each resulted in a few cases of chlorosis.

Donen (I.). **Studies in deciduous fruit. V. Preliminary observations on the relationship between nitrogenous metabolism and internal breakdown of Kelsey Plums in cold store.**—*Trans. roy. Soc. S. Afr.*, xxv, 1, pp. 83–102, 4 graphs, 1937.

A tabulated account is given of experiments in 1936 in Cape Town to determine the extent to which changes in the nitrogenous fractions in Kelsey plums (*Prunus salicina*) are related to the occurrence of internal breakdown during cold storage [*R.A.M.*, xiv, p. 321; xvi, p. 620]. The results showed that rapid hydrolysis of proteins takes place in both immature and ripe plums under all storage conditions, the path of protein breakdown being protein nitrogen → 'rest' nitrogen (representing all soluble nitrogenous compounds of higher complexity than amino acids or asparagine) → amino nitrogen. The more important conclusions drawn from the work are that under conditions of advanced maturity and high storage temperature, nitrogenous changes in the plums tend towards the accumulation of amino acids, whilst asparagin breaks down to amino acids and ammonia; low temperature, on the other hand, prevents asparagin breakdown, and immaturity inhibits amino acid nitrogen accumulation. Storage studies indicated that internal breakdown is almost entirely confined to immature fruit, and was most pronounced at 35° F.; it was not observed in plums kept at either 50° or 70°. These results suggested that conditions of maturity and storage which interfere with the course of progressive breakdown of nitrogenous compounds are also those which interfere with the normal ripening of the fruit and favour internal breakdown. Chemical analysis of browned and non-browned portions of the flesh of the plums indicated that the total nitrogen is not evenly distributed; it is higher in the browned portion, the major portion of the difference being made up of asparagin and 'rest' nitrogen. The fact that this gradient, which was shown not to be due to differential evaporation of water from the outer and inner portions of the fruit, gradually changes its direction as the browning of the flesh slowly spreads outwards, strongly suggests that the phenomenon is intimately connected with the mechanism of internal breakdown. It was also observed that browning is accompanied by a swelling and final bursting of the cells. This explains why cavities develop in the flesh in advanced stages of browning.

Hurt (R. H.). **1. The control of Peach leaf curl, scab and brown rot. 2. Spray materials for Peaches.**—*Bull. Va Truck Exp. Sta.* 312, 16 pp., 1 fig., 1937.

Peach leaf curl [*Taphrina deformans*] may be controlled under

Virginian conditions by the application, according to local schedules, of 4–4–100 (or stronger) Bordeaux mixture, beginning at the dormant season, lime-sulphur (6 gals. in 94 of water), or coal tar oil sprays at the rate of 2½ gals. in 100, the last-named, however, not being generally recommended on account of their causticity to the foliage, and of expense. Sulphur treatments are also effective against scab [*Cladosporium carpophilum*: *R.A.M.*, xvi, p. 474], the first being given during the latter part of May. The blossom-blight phase of brown rot [*Sclerotinia fructicola*: loc. cit.] is uncommon but occasionally causes some damage in Virginia, the J. H. Hale and Red Bird varieties being the most susceptible. Lime-sulphur (6 to 8 qts. per 100 gals.) or one of the wettable sulphurs (summer strength) should be applied as the pink colour begins to show in the buds, a second treatment being given between 15th and 25th May, another during the latter part of June, and a fourth about the middle of July, followed by the most important pre-harvest application when high pressure (350 lb. or more) should be used to force the spray material through the foliage to the fruit. *S. fructicola* has been found in a viable state in old mummified fruits left for several years in the orchard, and the removal of these is therefore a valuable measure of control.

Home-made wettable 300- to 325-mesh sulphur, an inexpensive and efficient preparation for the control of *C. carpophilum* and *S. fructicola*, should be used at the rate of 5 to 6 lb. per 100 gals. water, with the addition of 4 to 5 lb. hydrated lime except for the pre-harvest spray. The wetting agents found to be most suitable for incorporation with the sulphur are fish-oil soaps, glutrin, goulac, and molasses; all except goulac are semi-liquid and should be used at the rate of 1 pint per 100 gals. to wet 10 lb. sulphur, goulac (a dust) being added in the proportion of 1 lb. per 100 gals. Effective commercial wettable sulphurs include kolofog [ibid., xvi, p. 542], flotation sulphur, mike sulphur [ibid., xvi, p. 659], micronized sulphur, sulcoloid, and crown sulphur. The zinc-lime spray [ibid., xvi, p. 477], introduced primarily for the control of bacterial shot hole of peach [*Bact. pruni*], is ineffectual for this purpose under local conditions but stimulates foliar development.

Wilson (E. E.). **The shot-hole disease of stone-fruit trees.**—*Bull. Calif. agric. Exp. Sta.* 608, 40 pp., 7 figs., 6 graphs, 1937.

Shot hole disease, caused by *Coryneum beijerinckii* [*Clasterosporium carpophilum*: *R.A.M.*, xvi, p. 393, and next abstract], consistently occasions loss to the peach, nectarine, almond, and apricot in California. The disease [the symptoms of which are described] affects the twigs, dormant buds, leaves, blossoms, and fruit but varies considerably in its severity on the different organs. The hot, dry Californian summer does not favour the development of the fungus, which survives on peaches as mycelium in the tissues of diseased twigs and buds, or as conidia produced within the blighted buds. On apricots the fungus survives in the blighted dormant buds, lesions on the twigs being rare, and on almonds as mycelium in the twig lesions, more particularly as mycelium and spores in the blighted dormant buds, and to some extent as mycelium and spores in the blighted blossoms that remain on the tree.

Rain is probably the most important factor in the dissemination of the fungus about the trees, since spores are not easily dislodged by air currents whereas drops of water carry numerous spores downward, and possibly, during strong wind, to other trees.

The interval between entry of the fungus into the host and the appearance of symptoms is from five to eight days in leaves, and from seven to about 20 days in twigs, but variations in temperature affect the length of the incubation period.

In two experiments leaf infection did not develop unless the leaves were kept moist for at least 24 hours after inoculation, and under the conditions prevailing in 1935–6 infection did not take place during the first autumn rains but occurred in abundance during long rainy periods in winter.

In control experiments on almonds over a period of three years, Bordeaux mixture (5–5–50 and 6–6–50) was more effective than lime-sulphur, coposil, and certain copper preparations. The application giving most satisfactory control on blossom buds, blossoms, and leaves was that applied first as the blossom buds were beginning to swell, but autumn applications controlled the twig infection more effectively. Sprays applied when the blossoms were emerging and later were valuable only as supplementary sprays. The results obtained from applications of Bordeaux mixture on various dates from 18th October to 16th December indicated that twig infection was more effectively controlled the nearer the date of application was to the beginning of the rain on 26th December. With almonds control of twig infection was not followed by a commensurate decrease in leaf infection but with peaches the sprays most effective against twig infection also gave the best control of leaf infection.

Faure (J. F.). **Les traitements contre le Coryneum du Pêcher dans la vallée du Rhône.** [Measures for the control of the Peach *Coryneum* in the Rhone valley.]—*Progr. agric. vitic.*, cviii, 45, pp. 424–426, 1937.

Increasing injury is stated to be caused to the peach by *Coryneum* [*Clasterosporium carpophilum*] in the Rhone valley [*R.A.M.*, xii, p. 301], weak plants being particularly subject to the disease. For control the author recommends the application of Bordeaux mixture at leaf fall or even a little before, and one or two supplementary treatments between the beginning of November and January. Copper-calcium oxychlorides may only be used for spraying during the vegetation period.

Bouwens (Henriette). **Investigations about the mycorrhiza of fruit-trees, especially of Quince (Cydonia vulgaris) and of Strawberry plants (Fragaria vesca).**—*Zbl. Bakt.*, Abt. 2, xcvii, 1–3, pp. 34–49, 9 figs., 1937.

Mycorrhiza were observed by the writer in association with the roots of quince, pear, cherry, mulberry, apple, plum, and peach, in the Nijmegen district of Holland, where the first-named (the primary object of the investigations) is used as a stock for pears. Most of the material was supplied from Orleans and planted out in sandy soil, where the development of mycorrhiza is much more profuse than in

clay or peat. The endophyte was isolated as follows. In February mycorrhiza from quince taken from outdoor (non-disinfected) soil were placed in contact with young sterile quince plants in glass tubes on filter-paper in v. d. Crone's B solution, the roots of which were found by September to have developed an endophytic mycelium, arbuscles, and vesicles. From this material the endophyte was isolated on Burgeff's, X, and Melin 1b agars, of which the last-named proved to be the most suitable. The endophyte is a *Rhizoctonia* with a white aerial mycelium making zonate growth on cherry agar; clamp-connexions are not formed. In synthesis with sterile plants in pure cultures the fungus penetrates the roots and occupies the cells in the form of 'pelotons' ['balls of wool']; so far no vesicles have been detected. A species of *Cylindrocarpon* consistently isolated from quince roots failed to induce mycorrhizal formation on inoculation into sterile material, and a number of other oganisms tested also gave negative results.

Similar experiments with sterile strawberry seedlings of the Madame Moutot and other varieties also yielded a species of *Rhizoctonia* which produced mycorrhiza in inoculation experiments, whereas the *Pythium* and *Cylindrocarpon* isolated concurrently failed to do so. The strawberry *Rhizoctonia* resembles that of quince in its white, zonate mycelium without clamp-connexions, but differs in certain cultural characters. Yellow sclerotia are formed on X, malt, malt-salep, and oat agars. As in the case of quince the fungus develops in the cells in the form of 'pelotons', vesicles not having been observed hitherto.

WATERSTON (J. M.). **A note on the association of a species of Phytophthora with a 'die-back' disease of the Raspberry.**—*Trans. bot. Soc. Edinb.*, xxxii, 11, pp. 251–259, 2 pl., 2 figs., 1937.

The author states that since about 1932 a diseased condition of the Lloyd George raspberry, strongly resembling in its symptoms the black root rot described by Harris [*R.A.M.*, xi, p. 61], has been noticed locally in Scotland. The disease is characterized by the death of the young shoots, failure of buds on canes of the previous year to develop, the lack of extensive root formation in affected stools, and a definite die-back of the young roots from their tips. In the field the disease is restricted either to a few rows or to small localized patches, sometimes in hollows, suggesting excessive soil moisture as a predisposing factor. Dying roots were found regularly to contain Phycomycetous oospores enclosed in an elliptical oogonium; these oospores were also found in the roots of healthy stools from various localities in Scotland and in those of both healthy and black root rot stools in Kent. The oogonia vary in shape from broadly clavate to subspherical, and the oospores are spherical, hyaline to light yellow; in the four strains studied their mean diameter varied from 23·84 to 24·35 μ. Markedly papillate sporangia, 43 by 39 μ (mean), developed from diseased roots placed in tap water. The fungus is considered to belong to the *cactorum-omnivora* group of *Phytophthora*. The constant association of the organism with the disease, and the fact that in a stool with only one infected root, which was kept in water culture, the disease spread throughout the whole root system, while another one, from which all

roots showing infection had been carefully removed, remained healthy, lead the author to consider it a primary parasite, capable of assisting the invasion of the roots by secondary organisms under conditions unfavourable to the host.

Wann (F. B.) & Richards (B. L.). **The effect of pH on two Strawberry root rot fungi.**—*Proc. Utah Acad. Sci.*, xiv, pp. 45–46, 1937.

In these further studies [*R.A.M.*, xvi, p. 822] on the etiology of strawberry root rot the author reports preliminary experiments on the effect of the hydrogen-ion concentration on growth of two of the root rot organisms, viz., *Fusarium orthoceras* and *F. solani*. The former yielded from 50 c.c. of a glucose-mineral nutrient culture medium a uniform dry weight of mycelium of about 75 mg. at reactions varying from P_H 3·4 to 6·5, increasing to 108 mg. at P_H 6·8, falling to 74 mg. at P_H 7·2, and rising to a maximum of 138 mg. at P_H 9·2. A second experiment gave similar results. *F. solani* gave nearly uniform growth between P_H 3·4 and 9·2, with a slight, doubtfully significant maximum at P_H 7·7. The author suggests that adjustment of the soil to P_H 7·2, by the addition of acid fertilizers such as ammonium sulphate, sulphur, and sulphuric acid, might exert a beneficial effect on control of the disease.

Pal (N. L.), Chatterji (U. N.), & Ranjan (S.). **Effect of gases, from brick kilns, on Mango crops.**—Abs. in *Proc. Indian Sci. Congr., 1937*, xxiv, pp. 270–271, 1937.

Gases emanating from brick kilns are stated to cause heavy damage to the mango crop in the Allahabad district of India, consisting in the formation of black spots (gradually hardening as the fruits mature) towards the distal end, retardation of growth of the fruits, and premature shedding of the same. A chemical examination of the diseased fruits revealed precocious physiological ripening with consequent premature senescence. The trees and their foliage were apparently not adversely affected.

Simmonds (J. H.). **Diseases of the Papaw.**—*Qd agric. J.*, xlviii, 5, pp. 544–552, 3 pl., 1937.

A brief account is given of the more important diseases of papaw in Queensland, among which black spot (*Ascochyta caricae*) [*R.A.M.*, xiv, p. 216] is stated to be probably the most serious. The other fungal troubles discussed include powdery mildew [*Sphaerotheca* sp.: loc. cit. and ibid., xv, p. 281]; ripe rots of papaw fruits, associated with *A. caricae* and *Gloeosporium* sp.; a watery rot of the fruits caused by *Rhizopus nigricans*, which may be avoided by careful handling of the fruit and other sanitary measures during packing; and foot rot of individual young and old papaw trees caused by *Pythium ultimum* [ibid., xi, p. 330], for the control of which it is recommended that diseased trees should be immediately removed, and that the resulting holes should not be replanted for some time. Yellow crinkle [ibid., xvi, p. 155] commonly appears during the late summer and is usually restricted to scattered individuals, though as much as 25 per cent. infection has been recorded; it is apparently more serious following a period of drought. While the exact cause of the disease is not yet known, available evidence suggests that

it is of a virus nature, and affected plants should be eliminated as soon as found. A die-back, characterized by a general yellowing of the leaves accompanied by the death of a few of the younger ones and eventually leading to the withering and death of all the leaves, is believed to be a physiological disorder, somewhat akin to blossom-end rot of tomatoes. It may develop in both young and old trees and those in vigorous as well as in poor condition; it is most prevalent during protracted dry spells and appears to be immediately related to periods of hot, drying winds. Similar symptoms may also be caused by a partial root rot, following excessive rain. The trouble may be controlled by careful irrigation of the soil, and by the removal of the dead tops of the trees.

De Montal (P.). **L'air comprimé pour les traitements des arbres fruitiers.** [Compressed air for the treatment of fruit trees.]—*Agric. prat., Paris*, N.S., ci, 50, pp. 1750–1752, 2 figs., 1937.

Experiments have been successfully carried out in the walnut-producing centre of Grenoble, France, with an equipment specially constructed by the Société Mil's, Lyons, and about to be placed on the market, based on the simultaneous compression of air and spray solution. The excessively fine spray engendered by the new apparatus acts like a dust, rapidly ascending and penetrating the densest foliage, and the amount of solution required (20 l. per tree for entire coverage) is reduced by at least 50 per cent. The working pressures of the apparatus are 5 and 3 kg. for large and medium-sized trees, respectively.

Marsh (R. W.), Martin (H.), & Munson (R. G.). **Studies upon the copper fungicides. III. The distribution of fungicidal properties among certain copper compounds.**—*Ann. appl. Biol.*, xxiv, 4, pp. 853–866, 1 pl., 1937.

In continuation of this series of investigations [*R.A.M.*, xii, p. 774], the authors give a tabulated account of field experiments from 1934 to 1936 at Long Ashton, the results of which indicated that, judging by their relative efficacy in the control of potato late blight (*Phytophthora infestans*), a wide range of copper compounds, namely, cuprous and cupric oxides, cuprous cyanide, cuprous sulphite, cupric phosphate, cupric ammonium silicate, and cupric oxychloride, share common fungicidal powers. In all the three years, which were marked by very diverse weather conditions, the amount of copper residue remaining on the potato foliage from the Bordeaux mixture was greater than that from either cuprous or cupric oxide, but the residues from the latter substances were superior in fungicidal power to Bordeaux residues of the same copper content. In a field trial on pears against scab (*Venturia pirina*) cuprous cyanide proved to be slightly inferior to oil-Bordeaux-arsenate spray of similar copper content, and when tested on apple against *V. inaequalis* it was shown to be pronouncedly injurious to the host.

Symposium and discussion on laboratory technique for evaluating fungicidal properties.—*Trans. Brit. mycol. Soc.*, xxi, 1–2, pp. 118–144, 1 fig., 5 graphs, 1937.

This is a collection of papers by various authors, which were read

at a symposium held in January, 1936, at University College, London. In the first H. B. S. Montgomery and M. H. Moore describe a method which is being perfected at the East Malling Research Station for the laboratory evaluation of the fungicidal properties of Bordeaux and other sprays. Briefly outlined, it consists in testing the toxicity to the conidia of *Venturia inaequalis* of dried deposits of Bordeaux mixture on chemically clean glass slides. The fungus is grown on pieces of sterilized apple wood, from which spore suspensions are obtained by washing the surface of the piece of wood with sterile distilled water, when the culture is 10 to 12 days old; the suspension is adjusted to give about 80 spores per 2 mm. field, and is then put on the dry deposit on the slides and incubated at 20° C. Germination counts are made before growth on the slides has developed far enough to produce secondary conidia. A brief discussion follows of some of the results so far obtained and of the further applications and developments of the method.

In a discussion of the physico-chemical aspects of laboratory trials of fungicides, H. Martin stresses the importance, in biological tests of a new product, of collateral physico-chemical tests designed not only for the purpose of defining the new product, but also for the elucidation of its mode of action. The significance of such methods is illustrated by the fact that in experiments on the control of potato blight [*Phytophthora infestans*] the higher efficacy of cuprous oxide during the dry season of 1934 was correlated with its high availability, while in the wet 1935 season cupric oxide was the more effective, owing to the fact that it is better retained on the host leaves than cuprous oxide. Once the specific and physical properties of a substance have been determined, laboratory testing is reduced to the evaluation of these properties, and thus, for instance, standardization by biological methods of lime-sulphurs can be replaced by the analytical determination of their content of polysulphide sulphur. The complexity of the problems involved in laboratory trials, in which one or more of the variable factors affecting fungicidal efficacy in the field are maintained constant, is illustrated by a discussion of the standard procedures adopted by different workers for the application of sprays or dusts to test surfaces, leading to the conclusion that if the results of biological toxicity trials are to be applied to practice, consideration must be paid to the physico-chemical properties of the preparations.

R. G. Tomkins briefly discusses the preliminary testing in the laboratory of preparations destined for the preservation of foodstuffs, in order to determine their specific action on the germination and growth of fungi, as well as their volatility, solubility, and other properties which may be of importance. He points out that detailed knowledge of the fungicidal properties of a substance often suggests ways of improving its fungicidal action.

W. P. K. Findlay gives an account of the laboratory testing of wood preservatives [ibid., xv, p. 133], W. A. R. Dillon Weston outlines the work which is being done at Cambridge in the testing of liquid and dust fungicides for the disinfection of seed [ibid., xvi, p. 442], and in another paper A. E. Muskett describes analogous researches which are being carried out in Northern Ireland; he also briefly describes the

methods employed in Germany in official and industrial tests of seed-disinfecting preparations, as seen by him during a visit to that country in 1934.

Gallwitz (K.). **Untersuchungen an Leichtmetallen in Pflanzenschutz-spritzbrühen.** [Investigations on light metals in plant-protective spray mixtures.]—*Tech. in d. Landw.*, xviii, 12, pp. 226–228, 2 figs., 1 graph, 1937.

Only two of the alloys tested as substitutes for brass in the construction of spraying apparatus [*R.A.M.*, xvi, p. 825] gave any indication of possible utility in tests with 2 per cent. nosprasit 0, 2 per cent. nicotine, 10 per cent. Wacker's kupferkalk, and 15 per cent. lime-sulphur, and both of these consisted of rolled tin covered with a layer of eloxide, the adaptation of which to the purpose in view presents various technical difficulties.

Mol (Wilhelma A.). **Die Schimmelprobe.** [Testing for mould.]—*Z. Untersuch. Lebensmitt.*, lxxiv, 2–3, pp. 189–191, 1937.

The standard Dutch method of testing foodstuffs for mould contamination being open to various objections, the writer devised the following improved procedure. One gram of the substance to be examined is ground in a sterile mortar and converted with 10 c.c. sterile water into a homogeneous suspension, 1 c.c. of which is transferred by means of a sterile pipette to a Petri dish, mixed with 10 c.c. melted plum agar cooled to 45° C., and kept for three days in an incubator at 25°, this temperature being chosen to avoid the overrunning of the plates at 30° or above by *Aspergillus niger* and other *A.* spp., which prevent the recognition of *Penicillium glaucum*. It was further found advisable to add 1 gm. copper sulphate per 1,500 c.c. plum agar to prevent the overgrowth of the mould colonies by the greyish-white mycelium of *Mucor stolonifer* [*Rhizopus nigricans*]. Using this method of testing, mouldy cacao was usually found to form more than 50 colonies per 0·1 gm. agar. Maizena samples yielding more than 25 colonies per 0·1 gm. are unfit for consumption. In the case of nutmeg and pepper [*Piper nigrum*], a low incidence of mould contamination is correlated with a high etherial oil content, and the purity of these spices is best judged by the standard method of incubation (but at 25° instead of 37°).

Galloway (L. D.) & Burgess (R.). **Applied mycology and bacteriology.** —ix+186 pp., 1 pl., 20 figs., 1 diag., London, Leonard Hill, Ltd., 1937. Price 10*s*.

This manual is admittedly a mere review of essentials, intended to assist biologists and chemists in the co-ordination of their studies with those of other workers and give some indication of the scope and methods of economic microbiology. Part I deals with general matters, while Part II is concerned with specific applications to the food, fermentation, and textile industries [*R.A.M.*, xvii, p. 35], hygiene and medicine, agriculture, and miscellaneous industrial problems.

Heald (F. D.). **Introduction to plant pathology.**—xi+579 pp., 200 figs., London, McGraw-Hill Publishing Co., 1937. Price 24*s*.

This useful and well-produced treatise is described in the author's

preface as the outcome of 'a demand from teaching plant pathologists for a somewhat briefer treatment of the subject' than that followed in the 'Manual of Plant Diseases' [*R.A.M.*, vi, p. 109]. The present work, however, is not an abridgment of the earlier volume, but includes much added material, and involves an entirely different mode of presentation. The work is divided into six sections in which are discussed, respectively: general introductory subjects; diseases caused by Phycomycetes, Ascomycetes, Basidiomycetes, Fungi Imperfecti, and bacteria; virus diseases; non-parasitic diseases; plant disease control; and plant pathology methods. The results of recent advances in the various aspects of the subject have been incorporated as far as possible in the text.

Köhler (E.). **Neuere Vorstellungen von der Natur des pflanzenpathogenen Virus. Sammelreferat.** [Recent conceptions of the nature of the plant-pathogenic virus. A symposium.]—*Z. Bot.*, xxxi, 12, pp. 559–571, 1937.

This is a critical survey of some recent outstanding contributions to the understanding of plant viruses.

Findlay (G. M.). **Viruses and virus diseases.**—*Lancet*, ccxxxiii, 5959, pp. 1139–1140, 1937.

In the course of a paper on the nature of viruses read before a pathological meeting of the Liverpool Medical Institution on 28th October, 1937, attention was drawn to recent developments in the isolation of heavy proteins, probably nucleoproteins, from plant tissues infected by tobacco mosaic, tobacco ring spot, cucumber mosaic, potato X virus, and the bacteriophage, as well as from rabbit papillomata [*R.A.M.*, xvii, p. 52], equine encephalomyelitis, and yellow fever. Some of these heavy proteins can be obtained in crystalline and para-crystalline form and are apparently themselves the viruses, though it has been suggested that they are proteinases, capable of self-synthesis.

Peyronel (B.). **Le 'Endogone' quali produttrici di micorrize endotrofiche nelle fanerogame alpestri.** [The species of *Endogone* producing endotrophic mycorrhiza in Alpine phanerogams.]—*Nuovo G. bot. ital.*, N.S., xliv, 3, pp. 584–586, 1937.

Two of the species of *Endogone* previously reported [*R.A.M.*, iv, p. 755] to form endotrophic mycorrhiza in the roots of certain phanerogams in the Waldensian valley, Italy, are here referred to *E. vesiculifera* Thaxter and *E. fuegiana* Speg., the former occurring in *Viola palustris* and probably also in *Potentilla tormentilla*, *Caltha palustris*, and *Epilobium* spp., and the second in *V. palustris*, *Peucedanum ostruthium*, and *P. verticillare*. Other species of *Endogone*, as yet unidentified, have been found forming mycorrhiza in *Euphorbia dulcis*, *Phyteuma halleri*, *Lathyrus montanus*, and *Gentiana acaulis*.

Peyronel (B.). **Osservazioni e considerazioni sul fenomeno della micorrizia al Piccolo San Bernardo.** [Observations and reflections on the phenomenon of mycorrhizal development in the Little St. Bernard.]—*Nuovo G. bot. ital.*, N.S., xliv, 3, pp. 586–594, 1937.

Most of the wild plants growing in the Little St. Bernard region

(Piedmont) are stated to be furnished with mycorrhiza, which are little in evidence, on the other hand, among the species cultivated in the Alpine garden 'Chanousia'. Plants provided with endophytic mycorrhiza may be divided into two groups according to the nature of their rootlets—large and succulent or slender and filamentous. The extra-radical development of the mycorrhizal mycelium, frequently profuse, facilitates the passage of the organism from one host to another. The possible bearing of the scarcity of mycorrhiza in the Alpine garden on the poor condition of certain plants cultivated therein is discussed, but it is pointed out in this connexion that some of these also suffer from root rots due to *Rhizoctonia*, e.g., in *Thlaspi rotundifolium*, *Gypsophila repens*, and *Oxytropis foetida*, and to *Fusarium* in *O. parvupassuae*.

Wilson (A. R.). **Apparatus for growing plants under controlled environmental conditions.**—*Ann. appl. Biol.*, xxiv, 4, pp. 911–931, 2 pl., 8 diags., 1 graph, 1937.

The author gives a detailed account of the modifications introduced by him in 1935–6 to the Rothamsted chambers for growing plants under controlled conditions described by Stoughton [*R.A.M.*, ix, p. 523]. The new features include an inexpensive cooling apparatus, allowing the maintenance of temperatures inside the chamber as low as 5° C. at outer room temperatures of 16° to 18°. The type of humidifier adopted depends on the passage of air through a fine water mist from an atomizer device, and air is dried by passage over calcium chloride. Further details are an inexpensive, simple, and accurate lineametric, hair-operated hygrostat, controlling humidity within 2 per cent., a rough control of wind velocity within the chamber, and a semi-automatic watering device.

Lipman (C. B.). **Tolerance of liquid air temperatures by spore-free and very young cultures of fungi and bacteria on agar media.**—*Bull. Torrey bot. Cl.*, lxiv, 8, pp. 537–546, 1 pl., 1937.

Experiments are described in which a number of fungi and bacteria were exposed to liquid air temperatures on normal media for 48 hours. Of the 12 fungi tested, 8 (including *Penicillium luteum*, and species of *Mucor*, *Absidia*, *Mortierella*, *Trichoderma*, and *Fusarium*) grew normally after such exposure. *Erwinia amylovora* showed growth microscopically but not macroscopically whereas all the other bacteria (including *E. carotovora*) made copious growth.

Köhler (E.). **Ueber eine äusserst labile Linie des X-Mosaikvirus der Kartoffel.** [On an extremely unstable strain of the X-mosaic virus of the Potato.]—*Phytopath. Z.*, x, 5, pp. 467–479, 6 figs., 1937.

From the X-potato mosaic virus strain Cs 35 [*R.A.M.*, xvi, p. 704] the writer isolated a further strain, herein designated Cs 36, causing much more severe necrosis of Samson tobacco leaves, in the shape of confluent, conspicuously pale yellow, concentrically zonate lesions, than the parent form, but characterized by extreme instability. This was expressed by the frequent development of weaker variants, some approximating in virulence to the moderately strong parent strain Cs 35, while others more closely resembled the feebler strain Cs A from

which Cs 35 originated. Still fainter symptoms were induced by the new variant Cs n which may almost be termed latent. Cs 36 succumbed to ten minutes' heating at 67° C., whereas Cs 35 and Cs A were still capable of producing, respectively, moderate and slight necrosis after heating to 70°. In immunization experiments with the Mb 12 virus on tobacco leaves only partial protection against Cs 36 was obtained, necrotic rings appearing at and near the tips to which the defensive principle had presumably not penetrated. The symptoms induced by Cs 36 were uniformly observed to develop much more slowly than those following inoculation with Cs 35 and Cs A, and this retarded motion through the tissues is tentatively attributed to the comparatively large size and weight of the virus particles. Constitutional modifications of the latter are further held to be responsible for the variation phenomena reflected in the erratic appearance of the mutants described above. Such changes may be conceived as graduated associations and dissociations of molecules of the virus protein, and in the case of the excessively virulent Cs 36 are probably correlated with a progressive disintegration of the protein complex.

Kausche (G. A.). **Zur Frage der Beziehungen zwischen Virusinfekt und Stoffwechselphysiologie bei pflanzlichen Virosen.** [A contribution to the question of the relationships between virus infection and metabolic physiology in plant viroses.]—*Biochem. Z.*, ccxciv, 5–6, pp. 365–371, 3 graphs, 1937.

Samson tobacco leaves inoculated with a mixture of the H_{19s} and Cs 35 (X+X) potato viruses [see preceding abstract] underwent no severe malformations or stunting, whereas an X+Y blend produced an excessively dwarfing effect on the host. Buffering was increased in the infected plants, as compared with the controls, in both these experiments, especially the latter [ibid., xvii, p. 129]. The redox potentials of plants inoculated with an X+Y mixture were generally found to lie nearer the negative region of the scale than those of the controls, but these relationships may be reversed, and there were cases in which the curves overlapped.

The results of these tests do not appear to justify the conclusion that changes in the buffering of diseased plants arise exclusively as a sequel to virus infection, and any such connexion, even if convincingly demonstrated, would be applicable only within a limited scale of virus concentrations.

Heinze (K.) & Börger (H.). **Versuche zur Übertragung von Kartoffelvirosen auf Kartoffelsämlinge.** [Experiments in the transmission of Potato viruses to Potato seedlings.]—*Landw. Jb.*, lxxxv, 2, pp. 165–180, 7 figs., 1937.

Experiments were carried out at the Biological Institute, Berlin-Dahlem, to ascertain the feasibility of precocious seedling infection with certain potato viruses with a view to furthering the work of breeding for resistance by the timely elimination of susceptible individuals. The seedlings used were the W strains 25/31, 32/31, 23/34, 67/34, and the 9089 variety, all bred at the Institute. The peach aphids

(*Myzus persicae*) employed in the transmission tests were allowed to feed, mostly for a fortnight or more, on diseased potatoes prior to transference to healthy material.

When the insects infected with leaf roll were placed on the leaves of the seedlings, the symptoms developed so rapidly that more than half could be eliminated before transplanting to the field, while an even earlier appearance resulted from the infestation of the radicles of germinating seeds on damp blotting-paper in Petri dishes. The streak (Y) virus, non-transmissible by means of aphids, was successfully carried from infected to sound plants with the aid of a metal pipette (injection spray), followed by rubbing of the foliage. Definite streak symptoms were manifested long before the time for transplanting to the field. Attempts to transmit leaf roll when blended with streak (Y) by means of *M. persicae* gave much less successful results than when the leaf roll virus was used alone.

Boerger (A.). **Abbau-Erscheinungen, Saatgut-, Sorten-Fragen u.a. im Kartoffelbau. Sorgen um den Kartoffelbau in Südamerika.** [Degeneration manifestations, seed and variety problems, and so forth, in Potato cultivation. Anxieties concerning Potato cultivation in South America.]—*Dtsch. landw. Pr.*, lxiv, 46, pp. 559–560, 4 figs., 1937.

The steady increase of potato degeneration due to virus diseases, including leaf roll, in the Argentine during the last four years [*R.A.M.*, xv, p. 823; xvii, p. 57], culminating in the disastrous failure of the 1936–7 harvest, has necessitated the reorganization of the Uruguayan seed tuber supply, formerly largely met from this source. At the moment the seed for the winter plantings is mainly provided by New Zealand material. During 1936–7 the Argentine Ministry of Agriculture, with the aid of a special grant made in June, 1936, purchased 4,000 tons of certified seed [ibid., xvi, p. 144] of the Green Mountain, Katahdin, and Chippewa varieties from Canada and the United States, while a total of 6,870 tons was imported from North America and Europe by the trade. In February, 1937, the writer inspected the Argentine plantings and was greatly impressed by the superior health and productivity of the imported certified stock as compared with the degenerate native Chaqueña and Americana blanca stands. The economic aspects of the situation arising out of this reconstitution of the South American potato supply are briefly considered.

Smith (A. M.) & Paterson (W. Y.). **The study of variety and virus disease infection in tubers of Solanum tuberosum by the ascorbic acid test.**—*Bio-chem. J.*, xxxi, 11, pp. 1992–1999, 2 graphs, 1937.

A large number of healthy and diseased potato tubers (the latter infected by viruses or *Phytophthora infestans*) from the 1935, –6, and –7 crops in several Scottish centres were examined for ascorbic acid [*R.A.M.*, xvi, p. 707; cf. also ibid., xvi, p. 777] by the usual method of extraction with trichloroacetic acid and titration with 2:6-dichlorophenol-indophenol, as well as by a modification suitable for rapid routine purposes in which the cores were merely shaken for one minute

with 2 ml. 2 per cent. trichloroacetic acid and the mixture titrated with the indicator.

The effects of disease were studied by examining samples of six tubers certified as affected by different maladies after one month's storage. With one or two exceptions, tubers infected with mild and severe mosaic gave the same results within the limits of experimental error, and a mean figure has therefore been given for mosaic as a whole. The relatively few cases of leaf roll among the experimental material yielded data similar to those obtained from mosaic tubers. In both instances the reducing material is significantly greater (with one exception) than in comparable sound stock after the same storage period—an observation considered to be of great value as affording a simple means of testing the presence of virus infection in tubers. The following are some selected figures (in ml.) representing the amount of indophenol reduced by healthy and diseased tubers of certain varieties: Arran Pilot, healthy, mosaic, and blight, $1{\cdot}48\pm0{\cdot}08$, $2{\cdot}10\pm0{\cdot}05$, and $1{\cdot}09\pm0{\cdot}02$, respectively; similarly Eclipse, $2{\cdot}45\pm0{\cdot}07$, $3{\cdot}41\pm0{\cdot}09$, and $2{\cdot}03\pm0{\cdot}08$, respectively; Sharpe's Express $2{\cdot}66\pm0{\cdot}07$, $3{\cdot}33\pm0{\cdot}10$, and $1{\cdot}64\pm0{\cdot}08$, respectively; and King Edward, $2{\cdot}73\pm0{\cdot}08$, $3{\cdot}20\pm0{\cdot}14$, and $1{\cdot}71\pm0{\cdot}06$, respectively; Majestic, healthy, mosaic, leaf roll, and blight, $1{\cdot}54\pm0{\cdot}66$, $2{\cdot}37\pm0{\cdot}09$, $2{\cdot}15\pm0{\cdot}08$, and $1{\cdot}36\pm0{\cdot}05$, respectively; similarly Great Scot, $1{\cdot}88\pm0{\cdot}06$, $2{\cdot}30\pm0{\cdot}10$, $2{\cdot}29\pm0{\cdot}05$, and $1{\cdot}47\pm0{\cdot}04$, respectively; and Arran Banner, $2{\cdot}22\pm0{\cdot}07$, $3{\cdot}47\pm0{\cdot}11$, $2{\cdot}87\pm0{\cdot}05$, and $1{\cdot}66\pm0{\cdot}03$, respectively. It is of interest in this connexion to observe that blight-infected tubers contain less reducing substance than healthy ones.

The extreme variability of the ascorbic acid content of potato tubers, as manifested in the test material, appears to be independent of size, weight, soil constitution and manuring, and possibly also of seasonal conditions, being evidently correlated rather with varietal characters, health, and storage factors (especially duration). In general, a relatively low ascorbic acid content was associated with susceptibility to virus diseases (e.g. $5{\cdot}91\pm0{\cdot}9$ mg. per 100 gm. tuber substance in Redskin) and a relatively high one with resistance ($8{\cdot}21\pm0{\cdot}18$ in Kerr's Pink), but this rule was found to admit of occasional exceptions.

Stevenson (F. J.), Schultz (E. S.), Clark (C. F.), Cash (Lillian), & Bonde (R.). **Breeding for resistance to late blight in the Potato.**—*Phytopathology*, xxvii, 11, pp. 1059–1070, 2 figs., 1937.

Some of the results obtained in the writers' experiments in breeding potatoes for resistance to late blight (*Phytophthora infestans*) in the field in Maine and in the greenhouse at Beltsville, Maryland, have already been noticed from another source [*R.A.M.*, xvi, p. 54]. Certain progenies of crosses between two resistant varieties, e.g., No Blight× Ekishirazu, are all resistant, while a comparatively large number of seedlings raised from seed of German origin has escaped infection for three years. Resistance in such cases is not necessarily correlated with desirable commercial features, but the combination has been secured by crosses between (a) two resistant varieties, S45349 and Ekishirazu, (b) No Blight and Katahdin, and (c) two susceptible varieties, Chippewa and Katahdin. The tubers of a number of the varieties with resistant

vines are also resistant to the tuber rot caused by *P. infestans*. In plots sprayed with Bordeaux mixture, three of the resistant varieties tested were in the same class as the susceptible Green Mountain in yield, but in the untreated plots the differences between susceptible and resistant varieties were highly significant.

From the data obtained it is evident that blight resistance in the cultivated varieties is inherited as a recessive character, probably controlled by multiple genes.

Goossens (J.). **Aantastingen van Aardappelknollen van het ras Bintje door Alternaria solani in verband met beschadigingen en den rooidatum.** [Attacks on Potato tubers of the Bintje variety by *Alternaria solani* in relation to injuries and the date of lifting.]—*Tijdschr. PlZiekt.*, xliii, 11, pp. 266–277, 2 pl., 4 graphs, 1937. [French summary.]

During the winter of 1935–6 the writer repeatedly examined a batch of Bintje potato tubers (750 kg.) for the presence of *Alternaria solani* [*R.A.M.*, xiii, p. 54], removing the diseased tubers at each inspection. Fresh infections, however, continually developed on the hitherto apparently sound material, mostly (in 415 out of 480 cases) in cortical abrasions, at the hilum, or in mechanical injuries. In inoculation tests through wounds the fungal spots were sometimes formed at a short distance from the actual site of infection. In some cases the spots produced by the fungus in the interior of the tubers were so minute as readily to escape detection in the early stages of the disease. The results of inoculations through the hilum and wounds on tubers lifted on four dates between 13th July and 7th September indicate that, on the whole, infection is most prevalent on early dug potatoes.

Mader (E. O.) & Mader (Mary T.). **Effect of Bordeaux mixture on three varieties of Potatoes with respect to yields, composition of tubers, and control of scab.**—*Phytopathology*, xxvii, 11, pp. 1032–1045, 2 graphs, 1937.

Bordeaux mixture, of different concentrations, applied in varying doses at the rate of 100 gals. per acre at 400 lb. pressure, entailing a total consumption of copper sulphate of 75 lb. per acre for the season, retarded the flowering of Irish Cobbler and Green Mountain potatoes. The tuber and foliage weights of these two varieties and Rural Russet exceeded those of untreated plants, and all the sprayed plants retained more tubers per plant than the controls. Tubers of sprayed plants of all varieties showed a marked reduction in the percentage of scab [*Actinomyces scabies*: *R.A.M.*, xiv, p. 716] as compared with those from the untreated controls. In the early stages of tuber enlargement, the largest tubers of both treated and untreated plants were more extensively infected by scab than the smaller ones, but scabby tubers developed more slowly than sound ones, so that a higher percentage of diseased tubers fell into the smaller weight classes at maturity. At maturity the tubers from sprayed plants contained more copper, total nitrogen, reducing sugar, and starch, than those from untreated ones, with a lower ratio of protein to starch.

SVINHUFVUD (V. E.). **Untersuchungen über die bodenmikrobiologischen Grundlagen der Cajanderschen Waldtypen.** [Studies on the soil microbiological foundations of Cajander's forest types.]—*Erdész. kisérl.*, xxxix, 3–4, pp. 311–336, 1937.

The results of the writer's studies in Finland on the relation of the various groups of soil fungi and other micro-organisms to different forest types on the basis of Cajander's system of classification have already been noticed from another source [*R.A.M.*, xvi, p. 710].

BORZINI (G.). **Su di un attacco di Sclerotinia libertiana Fuck. in piante di Finocchio e sul parassitismo della stessa in associazione con altri funghi.** [On an attack of *Sclerotinia libertiana* Fuck. on Fennel and its parasitism in association with other fungi.]—*Boll. Staz. Pat. veg. Roma*, N.S., xvii, 2, pp. 225–266, 14 figs., 1937.

This is an expanded account of a paper on *Sclerotinia libertiana* [*S.* sclerotiorum] already noticed from another source [*R.A.M.*, xvii, p. 135].

STEVENSON (G. C.). **Studies on gumming disease of Sugar Cane.**—*Bull. Brit. W. Ind. centr. Sug. Cane Breed. Sta.* 16, pp. 1–9, 1937.

In the first part of this paper, the author gives an expanded account of tests of 20 varieties of sugar-cane for resistance to gumming disease (*Bacterium vasculorum*) by the gum exudation method previously described [*R.A.M.*, xvi, p. 410]. The tabulated data show that in seven varieties with either very slight or no leaf symptoms no gum exudation occurred, whereas those varieties exuding appreciable quantities of gum manifested heavy or very heavy leaf symptoms. There was, however, no essential correlation between severe leaf symptoms and high gum exudation for B. 3316; B. 3369 and Ba. 11569 showed marked leaf symptoms but relatively little gum exudation.

In continuation of his studies on the inheritance of resistance to gumming disease, the author gives data supplementary to those already published [ibid., xv, p. 397]. The effect of the male parent is clearly seen in crosses with the very susceptible Ba. 11569 as female parent, the resistance of the progeny from crosses with Ba. 6032, B. 606, B. 603, S.C. 12/4, B.H. 10 (12), and B. 417 (ranging in sequence from very susceptible to very resistant), being 27, 67, 78, 68, 82, and 87, respectively. A very high percentage of resistant types has appeared in progenies of crosses involving *Saccharum spontaneum* and *S. barberi*, and, even in the fourth and fifth nobilizations in the 'glagah' blood line, resistance percentages of from 96 to 100 per cent. are found.

PETCH (T.). **Yorkshire Hypocreales.**—*Naturalist, Lond., 1937*, 970, pp. 279–283, 1937.

In this list of Hypocreales recorded from Yorkshire the following items are mentioned. The fungus causing apple canker [*Nectria galligena*] is listed as *Dialonectria galligena* (Bres.) Petch [presumably a new combination], *N. ditissima* is referred to *N. punicea* (K. & S.) Fr., and *Claviceps microcephala* is given as a synonym of *C. purpurea* found on the inflorescence of grasses [*R.A.M.*, xvii, p. 104].

Baker (R. E. D.). **Additions and corrections to the further preliminary list of Trinidad fungi by C. A. Thorold, 1931.**—*Trop. Agriculture, Trin.*, xiv, 11, pp. 316–319, 1937.

This is a list, arranged in the systematic order of the organisms, of 110 species of fungi recorded in Trinidad since the publication of Thorold's previous list [*R.A.M.*, xi, p. 474]. Included in the number are 49 species of *Cercospora* collected in 1933 and 1934 by W. F. Steven, a number of which were identified by C. Chupp.

Peyronel (B.). **Sulla presenza della 'Valdensia heterodoxa' in Val d'Aosta e sul suo isolamento in cultura pura.** [On the presence of *Valdensia heterodoxa* in Val d'Aosta and on its isolation in pure culture.]—*Nuovo G. bot. ital.*, N.S., xliv, 3, pp. 581–583, 1937.

Attention is drawn to the recent detection on *Vaccinium myrtillus*, *Oxalis acetosella*, *Mulgedium alpinum*, and *Adenostyles alpina* in Val d'Aosta of *Valdensia heterodoxa*, formerly observed by the writer in the Waldensian valleys of Piedmont and also occurring in the U.S.S.R. and Poland [*R.A.M.*, viii, p. 631]. The number of hosts now known to be attacked by the fungus is 33. Pure cultures were obtained as follows. Leaves bearing the propagative organs of the fungus were placed on damp blotting-paper in Petri dishes and covered, at a height of 1 to 2 cm., with a broad sheet of flamed glass. In a short time the bulbils are shot from the leaves and adhere to the glass, from which they are readily detached by means of a platinum needle and transferred to carrot agar. On this medium *V. heterodoxa* does not produce its characteristic organs of propagation, but exclusively sclerotia and microconidia closely resembling those of *Sclerotinia fructigena*, *S. cinerea*, and allied species, to which the fungus under discussion is probably nearly related.

Yen (W. Y.). **Note sur quelques Ustilaginées marocaines.** [Note on some Ustilagineae from Morocco.]—*Rev. Mycologie*, N.S. ii, 2, pp. 76–84, 5 figs., 1937.

An account is given of the author's cultural studies on three of the five species of smuts sent to him from Morocco by Malençon, among which special mention may be made of *Sphacelotheca columellifera* (Tul.) Yen [a revised description of which is appended] on *Andropogon laniger*, and *S. schweinfurthiana* on *Imperata cylindrica*.

Watzl (O.). **Über die Bäume und Sträucher des von der Baramba entwässerten Gebietes der Chodschalgruppe und deren Blattkrankheiten. (Ein Beitrag zur Flora des südwestlichen Zentralkaukasus.) II. Pilze an lebenden Blättern.** [On the trees and shrubs of the region of the Khodja group drained by the Baramba and their leaf diseases. (A contribution to the flora of the south-western central Caucasus.) II. Fungi on living leaves.]—*Beih. bot. Zbl.*, Abt. B, lvii, 3, pp. 431–440, 1937.

In this list of about 40 fungi (identified by F. Petrak) observed parasitizing leaves of trees and shrubs in the Khodja region of the south-western central Caucasus (U.S.S.R.) in 1928 are included *Creoseptoria watzlii* Pet. n.g., n.sp. (with filamentous, hyaline, indistinctly

pluriseptate conidia, differing from *Septoria* in its typically hypocreoid features) on *Alnus glutinosa* var. *denticulata*, and *Petrakia deviata* n.sp. on *Acer campestre* var. *leiocarpum*.

MORITZ (O.). **Neuere biochemische und serologische Arbeiten auf dem Gebiet der pflanzlichen Viruskrankheiten.** [Recent biochemical and serological studies in the field of plant virus diseases.]—*Phytopath. Z.*, x, 5, pp. 554–558, 1937.

The author summarizes the outcome of some recent outstanding biochemical and serological contributions [all of which have been noticed in this *Review*] to the knowledge of the tobacco mosaic virus protein and certain other viruses.

GRATIA (A.) & MANIL (P.). **De l'ultracentrifugation des virus des plantes.** [On the ultracentrifugation of plant viruses.]—*C.R. Soc. Biol., Paris*, cxxvi, 27, pp. 423–425, 1937.

In further studies on the ultracentrifugation of tobacco mosaic [*R.A.M.*, xvii, p. 207] it was found convenient to combine this process with Bawden's technique of heating the juice to 70° C. for a few moments and then adding 1 part of a saturated solution of ammonium sulphate containing 5 per cent. glacial acetic acid to 3 parts of the purified liquid. The resulting precipitate, of a mother-of-pearl-like appearance and silky texture, consists exclusively of Stanley's crystals. These are absent, however, from material of *Nicotiana glutinosa*, with local lesions due to the same virus, treated by the foregoing technique.

GRATIA (A.) & MANIL (P.). **Ultracentrifugation et cristallisation d'un mélange de virus de la mosaïque du Tabac et de bactériophage.** [The ultracentrifugation and crystallization of a mixture of the Tobacco mosaic virus and bacteriophage.]—*C.R. Soc. Biol., Paris*, cxxvi, 32, pp. 903–906, 1937.

Details are given of an experiment in the ultracentrifugation of a mixture of tobacco mosaic protein and the bacteriophage of [*Bacterium*] *coli* [*R.A.M.*, xv, p. 140], in which the latter was largely absorbed by the crystalline precipitate of the former. After the third recrystallization the mosaic protein still retained a strong bacteriophagic capacity, which had in fact sunk only from 10^6 to 10^4. This process of intensive assimilation of an entirely alien element by the tobacco mosaic protein is considered to afford an important clue to the virulence of Stanley's crystals [see preceding abstract].

MANIL (P.) & DRICOT (C.). **Relations entre le nombre de lésions et la concentration du virus infectant dans le cas de la mosaïque du Tabac sur Nicotiana glutinosa.** [Relations between the number of lesions and the concentration of the infective virus in the case of Tobacco mosaic on *Nicotiana glutinosa*.]—*C.R. Soc. Biol., Paris*, cxxvi, 32, pp. 918–922, 1937.

The following equation has been found useful in the calculation of the relationships between the number of lesions and the concentration

of tobacco mosaic on *Nicotiana glutinosa*: $Y = KX\frac{1}{n}$, in which Y = the number of lesions, X = the relative concentration of the virus, and K and n are constant factors [cf. *R.A.M.*, xvii, p. 207]. Some recent studies along similar lines are briefly discussed.

Loring (H. S.). **Accuracy in the measurement of the activity of Tobacco mosaic virus protein.**—*J. biol. Chem.*, cxxi, 2, pp. 637–647, 1937.

A comparison of the differences in the number of lesions produced by the same percentage difference in tobacco mosaic virus protein concentration [see preceding abstract] over a range of 10^{-9} to 10^{-4} gm. protein per c.c. indicates that the optimum concentration for the comparison of different samples of crystalline virus protein is about 10^{-6} gm. per c.c.

The results [which are fully tabulated and discussed] of a number of tests showed that differences in virus protein concentration of 10 per cent. or more are readily detectable by the half leaf method on Early Golden Cluster bean (*Phaseolus vulgaris*) when 40 to 50 leaves are used. When *Nicotiana glutinosa* serves as the test plant, the minimum difference in concentration that can be consistently distinguished with the same number of leaves is 20 per cent.

Seastone (C. V.), Loring (H. S.), & Chester (K. S.). **Anaphylaxis with Tobacco mosaic virus protein and hemocyanin.**—*J. Immunol.*, xxxiii, 5, pp. 407–418, 1937.

Crystallized tobacco mosaic virus protein, as shown by previously published data, fails to cause smooth muscle contraction in guinea-pig uteri *in vitro* [*R.A.M.*, xvi, p. 65], though it is anaphylactogenic when tested *in vivo* on sensitized animals. It has been suggested that the failure to obtain anaphylactic reactions *in vitro* may be due to the large size of the tobacco mosaic virus protein molecules [ibid., xvi, p. 212 *et passim*], and this hypothesis was to some extent confirmed by the positive results secured both in the isolated uterine horn and *in vivo* with the haemocyanin of the horseshoe crab, *Limulus polyphemus*, the molecular weight of which is only about one-sixth of that of the virus protein.

Franke (H. M.). **Die Neutralisation des klassischen Virus durch Preßsäfte lokalresistenter Pflanzen. (Vorläufige Mitteilung.)** [The neutralization of the ordinary virus by the expressed juices of locally resistant plants. (Preliminary note.)]—*Planta*, xxvii, 4, pp. 399–404, 1937.

A fully tabulated account is given of experiments in the neutralization of the ordinary tobacco mosaic virus by the expressed juice of the locally resistant *Nicotiana glutinosa* [see preceding abstract], the results of which point to the inactivation of the former by this means. However, pending the elaboration of more delicate technique, the complex problems arising out of this line of research cannot be thoroughly investigated.

WENT (JOHANNA C.). **The influence of various chemicals on the inactivation of Tobacco virus 1.**—*Phytopath. Z.*, x, 5, pp. 480–489, 3 graphs, 1937.

The action of certain chemicals on tobacco mosaic virus 1 was tested by means of the local lésion method, using hybrids of *Nicotiana glutinosa*×*N. tabacum* as host plants [*R.A.M.*, xv, p. 611]. Copper sulphate, mercuric chloride, and silver nitrate were found to cause extensive inactivation of the virus at concentrations of 0·25 to 1 per cent. [ibid., xv, p. 177], this effect increasing at higher dilutions of the virus when made prior to treatment with the chemical. However, when the virus-chemical mixture is diluted after treatment the virus appears to be reactivated. This reactivation occurs both with unpurified and purified dialysed virus, tested with copper sulphate and mercuric chloride, but not with silver nitrate, except that the latter permitted a partial reactivation (up to 20 per cent.) of the treated purified dialysed virus.

ROSS (A. F.) & VINSON (C. G.). **Mosaic disease of Tobacco. Action of proteoclastic enzymes on the virus fraction. Nature of the virus fraction from various species of plants.**—*Res. Bull. Mo. agric. Exp. Sta.* 258, 19 pp., 1937.

In continuation of the second-named writer's previous studies on the nature of the tobacco mosaic virus [*R.A.M.*, xiii, p. 658], the effect of trypsin [ibid., xiv, p. 199, and above, p. 209] on the infective principle under different conditions was investigated. Commercial trypsin was added to several types of purified preparations at the rate of 2 mg. per c.c., controls with an equal amount of the heat-inactivated enzyme also being maintained. The virulence of the treated preparations was determined by pin prick inoculations into young Turkish tobacco plants. The resultant data indicated that the inactivation of the virus by trypsin, which occurred within an hour of its addition to the preparations, is mainly due to adsorption. Similar experiments with pepsin [ibid., xiv, p. 260] denoted a gradual inactivation (in seven days) of the virus at P_H 3.

A method of purification is described, involving the use of amyl alcohol for the decomposition of the virus-safranin precipitate, which greatly reduces the ash content of the final preparation. Such preparations are believed to be as pure as those obtained by previous procedures, if not more so. Purified virus preparations from Turkish tobacco, *Nicotiana macrophylla*, *N. paniculata*, *N. trigonophylla*, *N. longifolia*, *Lycopersicum pimpinellifolium*, and Golden Pear tomatoes all contained roughly 16 per cent. nitrogen and 1 per cent. ash, calculated on the basis of the total solids present. The nitrogen content of purified virus preparations from twelve other plants ranged from 0·9 mg. per l. in King of Denmark spinach to 28·1 in *N. suaveolens* and 27 in *Hyoscyamus niger*, the presence of small amounts being correlated with a low degree of infectivity.

The outcome of these experiments is considered to support the view that the tobacco mosaic virus is either a simple protein or closely associated with such substances.

JOHNSON (J.). **An acquired partial immunity to the Tobacco streak disease.**—*Trans. Wis. Acad. Sci. Arts Lett.*, xxx, pp. 27–34, 5 pl., 1937.

In the experiments discussed in this paper approximately 800 potted tobacco plants of various ages, sizes, and degrees of vigour in the greenhouse were artificially inoculated with tobacco streak virus [*R.A.M.*, xv, p. 535; xvi, p. 569] over a period of nine months. All the plants developed typical symptoms of the disease, but after the first attack they all showed a characteristic early recovery, similar to that which occurs in field-infected plants [loc. cit.]. Reinoculation with the tobacco streak virus of 130 of the recovered plants failed in every instance to reproduce in them the necrotic form of the disease, while of the same number of controls, 115 yielded typical streak. The same reactions to the virus were also shown by certain varieties of *Nicotiana tabacum* and by *N. sylvestris* and *N. repanda*, whereas other species yielded mottling only, from which recovery was not evident, and still others chlorotic or very mild symptoms. Preliminary inoculation of tobacco plants with tobacco virus 1, cucumber virus 1, tobacco ring spot, potato ring spot, potato 'mottle', or potato veinbanding failed to protect the hosts against tobacco streak, and conversely the latter failed to give protection against the other viruses tested. The author believes that recovery from tobacco streak is a good example of acquired immunity in plants, and that in the case of some vegetatively propagated crops artificial immunization against certain virus diseases may eventually become a practical control measure.

BRAUN (A. C.). **Beiträge zur Frage der Toxinbildung durch Pseudomonas tabaci (Wo. et Fo.) Stapp.** [Contributions to the question of toxin formation by *Pseudomonas tabaci* (Wo. & Fo.) Stapp.]—*Zbl. Bakt.*, Abt. 2, xcvii, 9–13, pp. 177–193, 4 figs., 1937.

A tabulated description is given of studies to determine the influence of cultural, biochemical, and physical factors on toxin formation by *Pseudomonas tabaci* [*Bacterium tabacum*: *R.A.M.*, xvii, p. 205], using young bean (*Phaseolus vulgaris*) leaves as test material. The strongest toxic effects were produced by cultures of the organism from a mineral salt solution with potassium nitrate as the source of nitrogen and levulose or saccharose as that of carbon. When the source of nitrogen was varied and glucose given as a source of carbon, the strongest stimulus to toxin production was afforded by gelatine, followed by peptone or tryptophane. With varying carbon nitrogen ratios (glucose: potassium nitrate) toxin formation was most abundant at concentrations of 0·025 to 1 per cent. nitrate and 1 to 2 per cent. glucose. The optimum temperature for toxin production by *Bact. tabacum* was found to be about 25° C., and the process was greatly favoured by a liberal access of oxygen to the cultures, the addition to which of infinitesimal amounts of iron sulphate not only promoted toxin formation in a striking degree, but also counteracted the adverse effects of copper sulphate on the organism. The capacity of *Bact. tabacum* for toxin production was best maintained by weekly subculturing on potato juice agar. Toxin formation is usually, but not invariably, associated with

abundant development in culture, but no definite correlation could be detected between toxin production and the capacity for liquefying gelatine. The toxin of *Bact. tabacum* partially destroys the leaf chlorophyll of tobacco with such rapidity that intermediate products cannot be spectrographically identified.

WINGARD (S. A.) & HENDERSON (R. G.). **Control of Tobacco blue mould (downy mildew).**—*Bull. Va agric. exp. Sta.* 313, 10 pp., 4 figs., 1937.

Following a brief, popular account of the symptoms and etiology of blue mould or downy mildew of tobacco [*Peronospora tabacina*], the writers discuss the control of this disease, which assumed an epidemic form in Virginia in 1937, by cultural methods (including the judicious application of top dressings of nitrate of soda at the rate of 4 to 5 lb. per sq. yd. of seed-bed), spraying, and fumigation. The most satisfactory spray is a mixture of ½ lb. red copper oxide, 1 qt. lethane spreader (Rohm and Haas), ½ gal. cottonseed (also known commercially as Wesson) oil, and sufficient water to make 50 gals. About 2½ gals. of this mixture should cover 100 sq. yds. of a bed containing small plants, but 5 to 7 will be required for larger ones. Eight to 12 applications should be given, at least 3 or 4 being made before infection becomes general. The chief advantage of spraying over benzol fumigation [full directions for which are given: see above, p. 212] is its comparative cheapness ($3 to 4 per 100 sq. yds., excluding the cost of the outfit).

KÜRBIS (W. P.). **Zur Pilzflora der Rhizosphäre der Esche.** [Note on the fungal flora in the rhizosphere of the Ash.]—*Mitt. Forstwirt. Forstwiss.*, viii, 3, pp. 289–292, 1 fig., 2 graphs, 1937.

This is a condensed summary of the results obtained by the author in his studies of the fungi found by him in the rhizosphere of the ash (*Fraxinus excelsior*) from various localities in Germany, a full report of which has already been noticed from another source [*R.A.M.*, xvi, p. 503].

MACDONALD (J. A.) & RUSSELL (J. R.). **Phomopsis scobina (Cke) v. Höhn. and Phomopsis controversa (Sacc.) Trav. on Ash.**—*Trans. bot. Soc. Edinb.*, xxxii, 2, pp. 341–352, 2 pl., 1937.

Phomopsis scobina and *P. controversa* are found on the ash (*Fraxinus excelsior*) in a number of districts in Scotland where they occur either as saprophytes on dead twigs, fruits, and leaves, or as parasites on living tissues, being associated with die-back of the twigs and canker of the stem.

In culture the two species showed considerable differences. *P. scobina* developed a slow growing, tufted mycelium, white at first, but ultimately often developing a pink tinge, and without any black zone lines round the pycnidia. The 'a' spores measured 7 to 13 by 2 to 4 μ, with an average of 10·5 by 3 μ, and the 'b' spores were 16·5 to 25 (average 20·5) by 1 μ. Both types were hyaline. The pycnidia of *P. controversa* showed dark zone lines and contained only 'a' spores which are hyaline and measure 5·5 to 9 by 1·5 to 4 μ, with an average

of 7 by 2·5 μ. It produces a rapidly growing superficial mycelium, which is white and woolly.

When both species were inoculated into plum or apple fruits *P. scobina* caused a slower and drier rot than *P. controversa* and produced numerous pycnidia, whereas *P. controversa* produced none. When inoculated into T-shaped cuts made in the bark of sterilized ash twigs, the mycelium of *P. scobina* penetrated the tissues of the twig, but the mycelium of *P. controversa* grew only on the surface and did not enter into the internal tissues to any great extent. The best method of infecting ash trees was to insert pieces of mycelium from pure cultures into T-shaped cuts in the young bark of twigs of one to three years of age; 72 per cent. (36 out of 50) of such inoculations with *P. scobina* and 48 per cent. (43 out of 90) with *P. controversa* proved successful. Some of the lesions formed by *P. scobina* on the larger branches measured 25 cm. in length, completely encircling them and showing a brown sunken bark with pycnidia freely formed on it. In old infections the bark cracks and drops away. Sometimes the fungus produces a mild witches' broom effect on young twigs of ash. *P. controversa* may occasionally kill smaller twigs, but it forms only small cankers on larger stems and their growth is soon stopped by the formation of a cork barrier. The spread of *P. controversa* appears to be much slower than that of *P. scobina*.

It has been suggested by Grove and others that *P. scobina* is identical with *P. controversa*, but the present authors consider that the existing differences, both in pathogenicity towards ash and in cultural characters, are sufficient to indicate that they are two distinct species.

Van den Broek (M.). **De gomziekte der Amygdaleeën in vergelijking met den boomkanker.** [The gumming disease of the Amygdalaceae in comparison with tree canker.]—*Tijdschr. PlZiekt.*, xliii, 10, pp. 238–248, 1937.

A review is given of some important contributions to the understanding of non-parasitic gummosis of stone fruits [cf. *R.A.M.*, xv, pp. 427, 587, *et passim*], with special reference to the occurrence of the condition in cherries (particularly grafts) in Holland, which is attributed primarily to an excessive accumulation of nutrient salts in the stems and branches consequent on an unbalanced supply of nitrogenous manure. The disorder, like (physiological) apple canker, with which gummosis presents numerous analogies, is most prevalent on heavy, non-permeable soils. Pruning wounds are not, in themselves, a cause of gummosis but the indiscriminate removal of branches may promote its development by disturbing the equilibrium between the root system and the crown, so that the latter cannot properly assimilate the salts derived from the soil. It is obvious that all attempts to combat the disease must be based on the avoidance of the errors in cultivation giving rise to such maladjustments in the metabolism of the trees.

Sprengel (F.). **Ueber die Kropfkrankheit an Eiche, Kiefer und Fichte.** [Note on the 'goitre' disease of Oak, Pine, and Spruce.]—*Mitt. Forstwirt. Forstwiss.*, viii, 3, pp. 340–343, 8 figs., 1937.

The author states that cytological studies of oak, pine, and spruce

wood from trees affected with the 'goitre' condition in Germany [*R.A.M.*, xvi, p. 353] indicated that in all three hosts the disease originates in one or in a very few cells of the cambium, which appear to be of varying thickness and of a shorter length than normal; these cells proliferate abnormally and develop into a 'goitre', while the adjoining cambium remains unaffected. In the oak the affected cambium usually dies in the course of a few years, but in the pine and spruce it usually remains alive much longer. The disease has so far always been observed to originate in the first annual ring of the oak, while in the two conifers it may not appear until much later. The view is again expressed that the disorder may be due to a genetic predisposition of individual trees to react to unknown environmental factors.

CARTWRIGHT (K. T. St. G.). **A reinvestigation into the cause of 'brown Oak', Fistulina hepatica (Huds.) Fr.**—*Trans. Brit. mycol. Soc.*, xxi, 1–2, pp. 68–83, 7 pl. (2 col.), 6 figs., 1937.

In giving an account of his studies, started in 1933, the results of which showed that 'brown oak' [*R.A.M.*, xvii, p. 148] in the English oak (*Quercus pedunculata* and *Q. sessiflora*) is caused by *Fistulina hepatica* and not by a *Penicillium*, as described by Groom in 1915, the author states that a similar condition in sweet chestnut is also due to the same organism. The fungus was obtained in pure culture from almost all the samples of affected oak and chestnut wood examined, and its pathogenicity to oak was further proved by inserting a plug of 'brown oak' containing *F. hepatica* into an oak branch; eight months later discoloration was found to have occurred in both the sapwood and heartwood of the branch surrounding the inoculum, and mycelium of *F. hepatica* was observed in the wood at a distance of about 5 cm. from the latter. The identity of the fungus was established by comparison with a culture of *F. hepatica* obtained from sporophore tissue. In culture the fungus was shown to grow best at temperatures of 25° to 27° C., and preliminary experiments on its metabolism indicated that it may obtain a portion of its sugar supply from tannin. It is suggested that the brown amorphous material present in 'brown oak' may be a degradation product of the lignin and hemicellulose due to the action of the fungus. A reference is made to the mechanical tests of affected oak wood, the results of which have already been noticed [ibid., xiv, p. 413]. It is considered that 'brown oak' may be safely used where great strength is not required, since there is no risk of further decay in processed wood.

LORENZ (R. C.) & CHRISTENSEN (C. M.). **A survey of forest tree diseases and their relation to stand improvement in the Lake and Central States.**—U.S. Dep. Agric., Bur. Pl. Indus., 63 pp., 11 pl., 1 map, 1937. [Mimeographed.]

This manual gives a semi-popular account of the diseases of forest trees in the Lake and Central States of the United States. The extent of the injury caused by the different diseases is indicated and the conditions which favour their development described. A concluding section deals with forest practices in relation to their effects on disease.

Wilkins (W. H.), Ellis (E. M.), & Harley (J. L.). **The ecology of the larger fungi. I. Constancy and frequency of fungal species in relation to certain vegetation communities, particularly Oak and Beech.**—*Ann. appl. Biol.*, xxiv, 4, pp. 703–732, 1937.

The results of investigations carried out over a five-year period at Haslemere, Surrey, in an attempt to determine the relationship between the fungus flora and certain higher plant associations (communities), with particular reference to oak and beech woods, emphasized the general similarity of the fungus flora in these two types of wood and indicated that the distribution of fungus species, apart from parasites and those growing saprophytically on tree stumps and the like, is dependent on the nature of the substratum, whether humus or leaf litter, the substratum being determined by the nature of the subsoil, the nature and character of the dominant, subdominant, and ground vegetation, and certain climatic factors, such as moisture and temperature. Determinations of the constancy of occurrence of fungal species and of frequency of individuals of the same species are stated to form a convenient method of analysis, and a clear survey and comprehension of the fungal flora of any area can only be arrived at from a summation of the floras of the different ecological units composing that area.

Forest Research in India, 1936–37. Part I. Forest Research Institute.—92 pp., 1937.

The following items of phytopathological interest occur in this report [cf. *R.A.M.*, xvi, p. 146]. A large number of specimens of sal [*Shorea robusta*] root rot from Bihar and Orissa were examined bearing sporophores belonging to *Polyporus shoreae*, *Fomes tricolor*, and *F. fastuosus*.

The inspection of the roots of various forest trees revealed the presence of mycorrhizal fungi, definite fungal mantles being formed on sal and *Quercus incana* roots.

Inoculation experiments on *Pinus excelsa* and *Cedrus deodara* with *Trametes pini* and *F. annosus*, respectively, gave positive results.

A repetition of previous experiments confirmed the genetic relationships between *Peridermium orientale* (*P. complanatum*) on *Pinus longifolia* and *Coleosporium campanulae* on *Campanula colorata* and *C. canescens*; *Peridermium brevius* on *Pinus excelsa* and a new *Coleosporium* on *Senecio rufinervis*; *Peridermium piceae* on *Picea morinda* and *Chrysomyxa himalayensis* on *Rhododendron arboreum*; *Peridermium ephedrae* on *Ephedra vulgaris* and a new *Hyalopsora* on *Althyrium acrosticoides*; and *P. abies-pindroina* n.sp. [without a diagnosis] and a new *Uredinopsis* on *Polypodium* sp.

Details are given of new installations of ascu wood preservation [see above, p. 216] pressure plants and of further experiments in this method of impregnation.

Eradication of the Dutch Elm disease.—*Science*, N.S., lxxxvi, 2239, p. 485, 1937.

During the summer of 1937 the activities of the U.S. Federal forces engaged in the campaign against the Dutch elm disease [*Ceratostomella ulmi*: *R.A.M.*, xvii, p. 143] are estimated to have reduced the number of infected trees 25 per cent. below the previous year's figures in the

extensively invaded area extending 50 miles radially from New York City into Connecticut, New York State, and New Jersey. Only two new foci of infection were detected in 1937, in Ohio and West Virginia, and the diseased trees (six in all) were destroyed. New infections along the boundaries of the major zone of the disease were limited to isolated trees. There was, however, an increase of infections at Indianopolis, Indiana, where *C. ulmi* has been present since 1934, the fungus having been proved by laboratory cultures of twigs to occur in 31 trees. An autogyro observer inspected 11,000 miles of railroad rights of way, over which the imported logs introducing the disease into the United States were conveyed inland for cabinet-making purposes, and a follow-up ground crew visited points marked on his map.

RADULESCU (T.). **Beiträge zur Kenntnis der Baumkrankheiten. I. Teil. Untersuchungen über den Blasenrost der Weymouthskiefer. II. Teil. Versuche über das Ulmensterben. III. Teil. Das Verhalten eines Blaufäulepilzes in lebendem und in totem Holz.** [Contributions to the knowledge of tree diseases. Part I. Investigations on the blister rust of the Weymouth Pine. Part II. Experiments on the Elm die-back. Part III. The behaviour of a blue rot fungus in living and in dead wood.]—*Forstwiss. Zbl.*, lix, 19, pp. 597–609; 20, pp. 629–643; 21, pp. 677–683, 4 figs., 3 diags., 2 graphs, 1937.

With a view to determining the silvicultural importance of blister rust [*Cronartium ribicola*] of the Weymouth [white] pine [*Pinus strobus*] in Germany [*R.A.M.*, xvi, p. 219], the writer investigated the position in several Upper Bavarian forests. In a 52-year-old stand covering an area of 0·14 hect. 25 out of 73 felled trees were diseased (34 per cent.), 16 (22 per cent.) showing stem cankers, mostly from 7 to 20 years old, though reaching an age of 30 years or more in four of the trees without producing any apparent injury to their health. An examination of transverse sections of felled stems showed that the trees are able to withstand invasion by blister rust for 50 years or so, since cambial necrosis does not begin until 9 to 16 years (average 12) after infection; it then proceeds about three times (2 to 5 cm. per annum) as rapidly, however, as in the case of *Peridermium pini* [see above, p. 214] on *Pinus sylvestris*, trees attacked by which may survive for a century. Constitutional differences appear to play an important part in the reaction of *P. strobus* to blister rust, which has been found heavily infecting certain trees while sparing others in the immediate vicinity.

Summing up the results of his observations, the writer upholds the verdict of the white pine commission (Verlag Reichsnährstand, Abt. 'Der Deutsche Forstwirt', 1935) to the effect that a temporary suspension of cultivation of *P. strobus*, as recommended by Tubeuf [*R.A.M.*, xiv, p. 541 *et passim*] is not required on the basis of the present blister rust situation, though his insistence on stringent quarantine regulations and elimination of infected material is fully justified.

In laboratory and field experiments, conidial suspensions of *Ceratostomella ulmi* [see preceding abstract] were carried by the transpiration stream into the tracheae of elm (*Ulmus montana*), oak, ash, hornbeam [*Carpinus betulus*], and beech leaves, and conveyed through the opened veins into the conducting channels of the branches; the conidia did

not long remain viable, however, in the vessels of *U. montana*, none surviving 20 to 24 days. Vascular discolorations developed in *U. montana* and oak absorbing conidia through the water stream, but no tyloses were formed in elms treated with a fungal filtrate. Infection by *C. ulmi* may, under certain conditions not fully understood, lead to sickliness of the entire tree without any accompanying vascular discoloration, which is not a necessary feature of the disease.

The lower limit of the water content of Scots pine (*P. sylvestris*) sap wood permitting growth of the blue stain fungus, *Ceratostomella* [or *Grosmannia*] *pini* [ibid., xv, p. 827] was experimentally found to be 35 per cent., with an optimum at 38 to 65 per cent. and an upper limit of 150 per cent. Somewhat better growth was made in living than in dead wood with a water content of up to 115 per cent., beyond which point the position is reversed. It would thus appear that *C. pini* prefers living to dead wood as a substratum.

In a few tests carried out on white pine (*P. strobus*), *C. pini* penetrated the loose, broad-ringed wood of this species more deeply and rapidly, especially at a water content of 65 per cent. and upwards, than that of *P. sylvestris* with its denser texture. The pith was more extensively involved than the xylem. In the case of dead white pine material, substances deleterious to the fungus inhibit its normal production of sclerotial columns, perithecia, and conidiophores between the inner bark and the xylem.

The significance of these observations in relation to contemporary studies on the factors influencing the development of lignicolous fungi is briefly discussed.

Goidànich (G.). **Le alterazioni del legno da parassiti cromogeni.** [Changes in wood due to staining parasites.]—Reprinted from *Ital. agric.*, lxxiv, 8, 14 pp., 1 col. pl., 8 figs., 1937.

This is an abridged version of the writer's studies on the staining of coniferous wood by fungal parasites in Italy, a fuller account of which has been noticed from another source [*R.A.M.*, xvi, p. 578].

Rohde (T.). **Ueber die 'Schweizer' Douglasienschütte und ihren vermuteten Erreger Adelopus spec.** [On the 'Swiss' needle-fall of Douglas Firs and its supposed agent *Adelopus* sp.]—Reprinted from *Mitt. Forstwirt. Forstwiss.*, viii, 28 pp., 2 col. pl., 25 figs., 2 graphs, 1937.

This is a comprehensive survey of the contributions [already noticed here] made by the writer and others to the knowledge of the needle-fall of Douglas firs (*Pseudotsuga taxifolia*) caused by *Adelopus gäumanni* in Switzerland and Germany [*R.A.M.*, xvii, p. 85].

Lepik (E.). **Männiroosteist ja-koorepõletikest.** [Pine rusts and their distribution.]—*Eesti metsand. Aastar.*, viii, pp. 177–196, 4 figs., 1 map, 1937. [English summary.]

From his study of the herbarium material of Estonian pine rusts at the Phytopathological Experiment Station of Dorpat University the author concludes that *Cronartium ribicola* is, without doubt, of Asiatic origin, its original host being *Pinus cembra*. This comparatively

resistant tree, however, did not materially contribute to the spread of of the rust, which only assumed a formidable character after its introduction into Europe from America on *P. strobus* in 1705. The first observation on its occurrence in Europe was made in Estonia in 1854 by H. A. Dietrich on currant, and he named the fungus *C. ribicola* without a diagnosis, thereby forfeiting his claim to priority as its author, a distinction reserved for Fischer (1872). The same rust was also discovered by Dietrich on white pine and named *Peridermium pini* f. *corticola* [*R.A.M.*, xv, p. 619] in ignorance of its identity with *C. ribicola*. In addition to North America the white pine blister rust has invaded Japan and Saghalien Island, so that its distribution in the northern hemisphere may be termed general. Under Estonian conditions afforestation with white pine cannot be contemplated on account of the ravages of *C. ribicola*, which necessitates the annual eradication of infected individuals from parks and avenues in order to save the currant crops. Besides black, white, and red currants and gooseberries the rust attacks *Ribes alpinum*, *R. aureum*, *R. palmatum*, and *R. succirubrum* in various localities.

Alternate hosts of *C. flaccidum* (*C. asclepiadeum*) [ibid., xvii, p. 87] on *Pinus sylvestris* (as *Peridermium pini*) have been found to include several species of peony, *Vincetoxicum officinale* and *V. rehmanni*, *Verbena teucrioides*, and *Tropaeolum canariense*. *Pinus laricio* [*P. nigra*] var. *austriaca*, *P. montana*, and *P. sylvestris* are all liable to infection by *Coleosporium senecionis*, seven other species of which are also listed. *Melampsora pinitorqua* [see above, p. 214] occurs on poplars (*Populus alba*, *P. tremula*, and *P. canadensis*).

JUMP (J. A.). **Further notes on the disease of Himalayan Pines.**—*Bull. Morris Arbor. Univ. Pa*, i. 7, pp. 97–98, 1937.

During the exceptionally severe winter of 1933–4, Himalayan pines (*Pinus excelsa*) in Pennsylvania and New Jersey were seriously damaged by cankers due to *Sphaeropsis malorum* [*Physalospora obtusa*: *R.A.M.*, xvii, p. 46], which was isolated in pure culture and inoculated into three-year-old pine and young apple trees with positive results. It was evident from a study of the annual growth rings in dead *Pinus excelsa* trees that the old suberized cankers had originated in winters when unusually low temperatures prevailed and apparently created conditions favouring infection by *Physalospora obtusa*.

WILDE (S. A.). **Recent findings pertaining to the use of sulfuric acid for the control of damping-off disease.**—*J. For.*, xxxv, 12, pp. 1106–1110, 1937.

The results of field experiments in the control of damping-off [*Pythium* and *Rhizoctonia*: *R.A.M.*, ix, p. 8] in conifers in Wisconsin forest nurseries indicated that 2 per cent. is the maximum concentration of sulphuric acid, applied at the rate of 7 gals. per sq. ft., required for this purpose on non-calcareous sandy soils. Where the disease occurs in a mild form a reduction of strength to 1·5 per cent. may be feasible for autumn applications, and is advisable in any case for the treatment of spring-sown beds owing to the risk of chemical injury to the seedlings at this season. The sulphuric acid treatment is not suitable for

calcareous soils, which rapidly regain their original alkaline reaction after watering, and should be replaced by formaldehyde or some other method. Siliceous sand also tends to revert quickly to neutrality, but granitic sand maintains a sufficiently acid reaction.

ZYCHA (H.). **Über das Wachstum zweier holzzerstörender Pilze und ihr Verhältnis zur Kohlensäure.** [On the growth of two wood-destroying fungi and their relation to carbon dioxide.]—*Zbl. Bakt.*, Abt. 2, cxvii, 9–13, pp. 223–244, 2 figs., 2 diags., 8 graphs, 1937.

Comparative physiological studies on two wood-destroying fungi, the saprophyte *Coniophora cerebella* [*C. puteana*: see above p. 215] and the parasite *Polyporus* [*Fomes*] *annosus*, the agent of spruce red rot [*R.A.M.*, xvii, p. 86], revealed a far-reaching similarity. The fungi were cultured in flasks on malt solution, taking mycelial dry weight as a criterion of growth. The development of the organisms was stimulated by the addition of calcium carbonate to the medium, increasing concentrations of which up to 8 per cent. resulted in a proportionate augmentation of yield. *C. puteana* responds to light by increased growth, whereas *F. annosus* is indifferent. Both fungi are copious acid-formers. Carbon dioxide formation per gm. of mycelium amounts to 1 to 2 c.c. per hour in the case of *C. puteana* and to 2 to 3 c.c. in that of *F. annosus*, the apparently lower production of the former being due to its incomplete consumption of nutrients, since it actually forms more acid than *F. annosus*. With the aid of a special contrivance for the passage of gas through a series of flasks, the influence of a constant atmospheric content of carbon dioxide on the growth of the two fungi was investigated and found to be just as powerful in the case of the superficial *C. puteana* as in that of *F. annosus*, an occupant of the soil or of the internal tissues of spruce stems. The inhibition of growth was almost proportional to the carbon dioxide content of the surrounding air, and growth apparently ceased at 60 per cent., although death did not ensue at this concentration even after several days.

GISTL (R.). **Zur Kenntnis des 'echten Hausschwammes'.** [A contribution to the knowledge of the 'true dry rot fungus'.]—*NachrBl. dtsch. PflSchDienst*, xii, 4, pp. 225–233, 5 figs., 1 graph, 1937. [English, French, and Spanish summaries on pp. 345, 347–348, 350.]

The salient features of the author's study at the Munich Technical Institute on the physiology of the dry rot fungus (*Merulius lacrymans*) have already been noticed from another source [*R.A.M.*, xv, p. 695].

FINDLAY (W. P. K.). **Testing wood preservatives in the laboratory.**—*Pap. Brit. Wood Pres. Ass., 1935–6*, pp. 10–16, 1937.

A concise description is given of the methods employed at the Forest Products Research Laboratory, Princes Risborough, in the testing of wood preservatives in the laboratory [cf. above, p. 261].

RICHARDSON (N. A.). **Wood preservatives.**—*J. Soc. chem. Ind., Lond.*, lvi, 52, pp. 1148–1152, 1937.

Much of the information presented in this concise but comprehensive

survey of modern developments in timber preservation in England, especially in relation to wood-destroying fungi, has already been noticed here from other sources, but mention may be made of the following items. Magnesium silicofluoride is frequently recommended for the prevention of dry rot [*Merulius lacrymans*], but care should be taken to avoid contact with metal or glass, to which the compound is injurious. A special apparatus in use at the Forest Products Research Laboratory in connexion with the testing of preservatives by the wood block method [*R.A.M.*, xv, p. 546; xvi, p. 76] consists of a modified Soxhlet extractor for leaching-out trials. The use of this apparatus obviates the main objection to the common method of shaking the treated sample for a given number of times in a container with a fixed volume of cold water, viz., that the water becomes more or less saturated with the preservative salts, especially those of low solubility, so that the subsequent analytical data are apt to show the disinfectant in an unduly favourable light.

Osmose wood preservation.—*For. Chron.*, xiii, 4, pp. 506–508, 1937.

Excellent results are stated to have been obtained by the application of the so-called 'osmose' preservatives [*R.A.M.*, xv, p. 546] to spruce and balsam fir logs in the Laurentide Limit of the Anglo-Canadian Pulp & Paper Mills, Ltd. The substances used are supplied to the trade under the name of 'osmotite', which consists of dinitrophenol, sodium fluoride, and potassium bichromate in powder form, and is mixed in the field with 50 per cent. water. The logs were given a full-length treatment with a brush and covered with osmose waterproof paper for about eight weeks, after which they were examined for depth of penetration of the preservatives by means of the standard alizarin colour reagents. The depths of penetration were as follows: dinitrophenol in 5 in. spruce and $7\frac{3}{4}$ in. balsam fir logs, $\frac{5}{8}$ in. in both cases; sodium fluoride, $2\frac{1}{8}$ and 3 in., respectively. The treated wood has a clean, dry, odourless surface.

Ramsbottom (J.). **Dry rot in ships.**—*Essex Nat.*, xxv, 5, pp. 231–267, 1937.

An interesting account, amplified by numerous quotations from historical records and correspondence, is given of the ravages caused among the wooden vessels of the British Navy by dry rot (*Merulius lacrymans*, *Coniophora puteana*, and other fungi) from the earliest times until the introduction of ironclads in 1863.

Becker. **Kohlrüben-Fäulnis.** [Swede rot.]—*Dtsch. landw. Pr.*, lxiv, 48, p. 588, 1937.

A popular note is given on the occurrence of club root of swedes [*Plasmodiophora brassicae*] in the Eutin district [Oldenburg: *R.A.M.*, v, p. 529], where losses of up to 50 per cent. of the crop may be caused by the disease, which is sometimes so destructive as to necessitate the total abandonment of swedes in favour of beets. Livestock may be safely fed on diseased swedes, but care should be taken not to use contaminated manure on swede fields. The incidence of *P. brassicae*

is increased by the use of liquid manure, whereas calcium cyanamide [*R.A.M.*, xv, p. 335] reduces it.

CHITTENDEN (E.) & COOP (L. G. L.). **The use of borax in the control of brown-heart of Turnips.**—*N.Z. J. Sci. Tech.*, xix, 6, pp. 372–376, 2 figs., 1937.

Further experiments confirmed the highly beneficial effects of borax in the control of brown heart of Green Globe turnips in the Nelson district of New Zealand [*R.A.M.*, xvii, p. 152]. The best results were obtained by the use of 20 lb. borax per acre top-dressed over the land prior to sowing the seed, or by mixtures of ground limestone, superphosphate, and 10 lb. borax per acre sown with the seed in 14 in. drills. Even at the rate of 10 lb. per acre borax caused serious mortality of young turnips when mixed with superphosphate and the seed.

GOIDÀNICH (G.). **Sulle specie di Alternaria che producono il nerume del Cavolfiore in Italia.** [On the species of *Alternaria* which produce Cauliflower black spot in Italy.]—*Boll. Staz. Pat. veg. Roma*, N.S., xvii, 2, pp. 193–200, 1 fig., 1937.

During 1936–7 cauliflowers growing in the province of Pisa showed about 15 per cent. infection by black spot [*R.A.M.*, xv, p. 70], the disease first appearing in November or December, reaching a maximum in January or February, and virtually disappearing in March.

Isolations from lesions on the inflorescences yielded an *Alternaria* with spores averaging 130 to 229 by 15 to 24 μ, identified as *A. brassicae* (Berk.) Bolle. *A. brassicae* (Berk.) Sacc. listed by Bolle as a synonym of *A. circinans* also causes the disease in Italy, both fungi sometimes occurring on the same plant.

Other forms of *Alternaria*, probably saprophytic, were also isolated from the affected material.

THIEDE. **Zur Blattfleckenkrankheit und Schosserbildung bei Zuckerrüben. Beobachtungen an diesjährigen Zuckerrüben.** [On the leaf spot disease and 'bolter' formation in Sugar Beets. Observations on the current year's Sugar Beets.]—*Dtsch. landw. Pr.*, lxiv, 48, p. 588, 3 figs., 1937.

Leaf spot of sugar beets (*Cercospora beticola*) was more prevalent in some parts of Germany [see above, p. 220], especially the Altmark, in the autumn of 1937 than for some time past. The leaf yields of affected plants are substantially reduced, amounting in some cases to only a third of the normal, and moreover the foliage has to be acidified before use as fodder, since in the fresh state it is rejected by livestock. The beet production of affected stands falls more or less according to the time of onset of the disease, and factory percentages show that the sugar content fell to 16 or 17 per cent. During the period of these observations infection began early in September, spread rapidly in the warm, damp weather (mean maximum temperature 21·9° C.), and reached a climax at the end of the month. The selected E sugar-beet strains were found to be particularly susceptible to leaf spot, but the bearing of cultural factors, such as soil constitution and manuring, on the disease is obscure.

FOURMONT (P.). **De l'utilisation du formol pour la désinfection des semences de Betteraves.** [On the use of formalin for the disinfection of Beet seed.]—*C.R. Acad. Agric. Fr.*, xxiii, 31, pp. 981–984, 1937.

Good results were obtained in a limited series of tests at the Versailles Phytopathological Station in the control of *Phoma betae* on beet seed-clusters [see above, p. 220] by disinfection with formalin, but great care must be taken not to exceed certain well-defined limits (1, 0·5, 0·5, and 0·35 per cent., respectively, for varieties herein designated A, B, J, and R). The treatment resulted in an increase of germination over the controls amounting to 22, 45, and 10 per cent., respectively, in A, J, and R, whereas in the case of B a reduction of 9 per cent. resulted.

SCHMIDT (E. W.). **Der parasitäre Pflanzenkrebs und der Rübentumor.** [Parasitic crown gall and the Beet tumour.]—*Dtsch. Zuckerindustr.*, lxii, 51, pp. 1133–1134, 6 figs., 1937.

The examination of German beet material infected by crown gall (*Pseudomonas* [*Bacterium*] *tumefaciens*) [*R.A.M.*, x, p. 285] revealed a higher albumin and lower sugar content in the diseased than in the healthy tissues, nitrate nitrogen was more abundant in the latter, while tyrosinase and catalase occurred in greater profusion in the former.

SCHMIDT (E. W.). **Untersuchungen über die Ursache der Herz- und Trockenfäule der Rüben und die Bedeutung des Bors.** [Investigations on the cause of the heart and dry rot of Beets and the significance of boron.]—*Z. WirtschGr. Zuckerindustr.*, lxxxvii, 11, pp. 679–700, 8 figs., 1937.

Analyses of the nitrate-nitrogen content of diseased (heart and root rot) and healthy sugar beets in water cultures with and without boron (1·5 mg. per pot as borax) revealed an excess of nitrate-nitrogen in all organs of the plants deprived of the trace element [*R.A.M.*, xvii, p. 89]. Abnormally thick and very brittle leaves were produced by diseased beet seedlings. Beets in nitrogen-deficient sand cultures did not contract heart and root rot even in the absence of boron. Beet plants supplied with boron wilted more slowly and withdrew less nitrate from the soil solution than those deprived of this element. The cotyledons of beet seedlings receiving boron contained less calcium oxalate than those unprovided with this element. The application of sodium nitrate to a soil with a tendency to heart and root rot caused an increase of disease from 8·4 to 26·1 and from 5·2 to 26·5 per cent. in 1936 and 1937, respectively.

SCHMIDT (E. W.). **Über den Einfluss des Bors auf den Nitratstoffwechsel.** [On the influence of boron on nitrate metabolism.]—*Ber. dtsch. bot. Ges.*, lv, 7, pp. 356–361, 1937.

Details are given of the writer's analytical studies at the Kleinwanzleben Research Institute on the influence of boron on the nitrate metabolism of sugar beets, barley, and oats in sandy soil [see preceding abstract]. Applied to experimental plants in doses corresponding with the usual agricultural practice, boron caused disturbance in the nitrate metabolism of a definitely toxic character.

Schropp (W.) & Scharrer (K.). **Untersuchungen über die Wirkung des Bors bei verschiedener Wasserversorgung.** [Investigations on the action of boron with varying water supply.]—*Bodenk. u. Pfl-Ernähr.*, N.F., 1, 5–6, pp. 289–303, 1937.

A detailed description is given of the writer's pot experiments to determine the effects of boron on the growth of Eckendorf fodder beets in three different soil mixtures of varying reaction (P_H 7·16, 6·60, and 6·09) and water-holding capacities. Three grades of watering were employed—scanty, normal, and plentiful.

Heart and dry rot [*R.A.M.*, xv, p. 476, and preceding abstract] in all watering grades was more prevalent in the slightly and very slightly acid soils than in the alkaline series. Of much greater importance than the soil reaction in the prevention of the disease was a plentiful water supply, which also contributed to an increased yield except in naturally moist soils.

Boron (10 mg. per pot as boric acid) was uniformly helpful in the control of heart and dry rot and also slightly increased the yields of plants deprived of water in the absence of disease. The relative nitrogen content of healthy beet roots was generally lower than that of the leaves, whereas in particularly severe cases of heart and dry rot a reverse relation obtained. The addition of boron to the alkaline soil, combined with an increasing water supply, augmented the nitrogen content of roots and leaves; on soils with a heavy incidence of disease the trace element mostly lowered the nitrogen content of the root and raised that of the foliage in relation to the controls.

Hull (R.). **Effect of environmental conditions, and more particularly of soil moisture upon the emergence of Peas.**—*Ann. appl. Biol.*, xxiv, 4, pp. 681–689, 2 graphs, 1937.

The results of experiments during the winter and spring of 1933–4 and the spring of 1935 at Slough and in Cheshire with Pilot, Alaska, and Gradus peas showed that high soil moisture considerably reduced the emergence of seedlings, soil temperature being of less importance, and that Gradus with wrinkled seeds was more liable to fail in emergence than the other varieties, both with smooth seeds. Collateral pot experiments indicated that the reduction in stand is chiefly due to the activity of soil-borne organisms; high mortality of pea seeds and seedlings was experimentally shown to be caused under conditions of high soil moisture by a species of *Fusarium* and an unidentified Phycomycete, both of which were isolated from diseased seedlings, the last-named being distinctly the more active parasite under laboratory conditions. Material improvement in stands was obtained by dusting the dry seeds with a proprietary organic mercury compound. The growth of the aerial organs was not visibly affected by the maximum load of the preparation which the dry pea seed is able to carry, but the tap-roots of the seedlings were appreciably stunted in their development.

Botany and plant pathology.—*Rep. Ala. agric. Exp. Sta., 1936*, pp. 24–25, 1937. [Received January, 1938.]

The following item, contributed by J. L. Seal, is of interest in this

report. *Ascochyta pinodella* predominated as an agent of disease among winter peas and vetches [*Vicia* spp.] during 1936 in Alabama [*R.A.M.*, xiv, p. 428], though *A. pisi* and *Mycosphaerella pinodes* were also found in field plantings of winter peas, and the latter was further common in autumn canning pea plantings, frequently in the perfect stage. The organisms are carried in and on the seed, and so far no method of treatment has been devised to destroy them without injuring the seed. The fungi are also perpetuated from year to year in the soil, so that the development of resistant pea strains would appear to constitute the sole measure of control.

Wei (C. T.). **Rust resistance in the Garden Bean.**—*Phytopathology*, xxvii, 11, pp. 1090–1105, 1 fig., 1937.

Five major types of bean (*Phaseolus vulgaris*) rust (*Uromyces appendiculatus*, recently designated by Arthur *U. phaseoli typica*) are differentiated, based on the one hand on the extent of necrosis and on the other on the amount of sporulation developing in 50 varieties as a sequel to inoculation with a culture of the fungus from S. A. Wingard maintained on the susceptible Kentucky Wonder [*R.A.M.*, xiii, p. 205], viz., 0, 1, 2, 3, and 4 in descending order of resistance. Types 0 (subdivided into 0o (characteristic of Lazy Wife), 0a, and 0b (of Early Rogers, Refugee, Early Stringless Refugee, Hodson Wax, Idaho Refugee (in part), Stringless Refugee Wax, Wisconsin Refugee, and Scarlet Runner (*P. multiflorus*)), 1 (1a and 1b), and 2 are considered to be resistant, 3 and 4 susceptible, while plants showing symptoms partaking of the nature of both groups are intermediate and designated as X (Xa and Xb).

The reaction types do not fluctuate within a temperature range of 16° to 28° C., except that type 3 infection on the X group is proportionally increased both by high and low temperatures, the latter also prolonging the incubation period. Light is essential for the penetration of the fungus, a reduction of intensity prolonging the incubation period and, beyond a certain point, inducing necrosis in type 4 infection, besides increasing the proportion of type 3 infection in the X group.

Excess nitrogen augments the incidence of rust per unit area of the leaf and vice versa, whereas potassium exerts a diametrically opposite action. A low nitrogen : potassium ratio increases type 3 infection on the mesothetic (intermediate) varieties. The amount and type of infection were not influenced (except in one instance) by the addition of boron, lithium, zinc, or germanium to the standard nutrient solution unless the concentration was high enough to cause abnormal growth. Senescence of the host tissue tends to reduce the incidence of infection, but does not materially affect the type, except that the proportion of type 3 on the mesothetic hosts progressively increases and finally supersedes the other two types of infection. The nature of this protoplasmic resistance appears to be dual, resulting from a combined action of host and pathogen, the death of the former presumably being due to the action of toxins produced by the rust, and that of the latter to antibodies formed by the plant.

GOIDÀNICH (G.). **Notizie su una malattia della Vite poco conosciuta.** [Notes on a little known Vine disease.]—*R.C. Accad. Lincei*, xxvi, 3–4, pp. 107–112, 3 figs., 1937.

The fungus isolated from the elongated, rather narrow cankers situated chiefly on the lower internodes of necrotic vine stems (an unspecified white variety grafted on Kober 5 BB) near Trieste, Italy, was found to possess two kinds of pycnospores—one oval, basally pointed, 6 to 10·1 by 2·4 to 3 μ, the other (scolecospore) elongated, tapering towards both ends, hyaline, curved or flexuous, 18 to 23 by 1 to 1·5 μ. It is thus evidently a species of *Phomopsis* and may well be closely related to *P. cordifolia* (Brunn.) Died., reported as a vine parasite from Germany. It is still more nearly allied, however, to the imperfect stage of *Cryptosporella viticola*, the causal organism of 'dead arm' of vines in the United States, Japan [*R.A.M.*, iv, p. 650, and possibly Holland: ibid., xvi, p. 299]. Reddick misinterpreted the scolecospores of the pycnidial stage of *C. viticola* as paraphyses and named the fungus *Fusicoccum viticolum* in *Bull. N.Y. St. agric. Exp. Sta.* 389, 1914, which the author transfers to *Phomopsis* as *P. viticola* (Redd.) G. Goid. n. comb.

BITANCOURT (A. A.). **A organisação da defesa sanitaria vegetal na Republica Argentina.** [The organization of the sanitary protection of plants in the Argentine Republic.]—*Biologico*, iii, 10, pp. 289–297, 4 figs., 1 diag., 1937.

Most of the information given in this paper has already been noted from another source [*R.A.M.*, xv, p. 272]. The Department of Agricultural Protection, complementary to the Department of Plant Health but working independently of it, is stated to be responsible for the elaboration and application of measures for the control of pests and diseases.

Legislative and administrative measures.—*Int. Bull. Pl. Prot.*, xi, 11, pp. 249–250, 253–254, 1937.

ECUADOR. A Decree of 1st July, 1937, endorsing the phytosanitary agreement between Ecuador and Chile of 9th January, 1937, provides that avocados imported into Chile from Ecuador must emanate from regions free from anthracnose (*Physalospora perseae*) [*R.A.M.*, ix, p. 63] or in which the disease has been practically eliminated by continuous systematic control.

VENEZUELA. The presence of witches' broom of cacao (*Marasmius perniciosus*) having been notified in Sucre State and Federal Territory Delta Amacuro, Venezuela, measures are prescribed by Resolutions Nos. 6, 7, and 8 of 15th June, 1937, to prevent the spread of the disease to non-infected zones by (*a*) the prohibition of transport from infected areas of cacao plants or parts thereof, pods or beans, earth, sacks, or packing-cases utilized for cacao; (*b*) the disinfection of ships after transporting cacao from infected zones before leaving for other regions of the country; and (*c*) the exclusion from the country of any cacao plant, fruit, seed, or other part of whatever origin, of sacks or other material previously utilized for the packing of cacao, and of soil, irrespective of the place of origin.